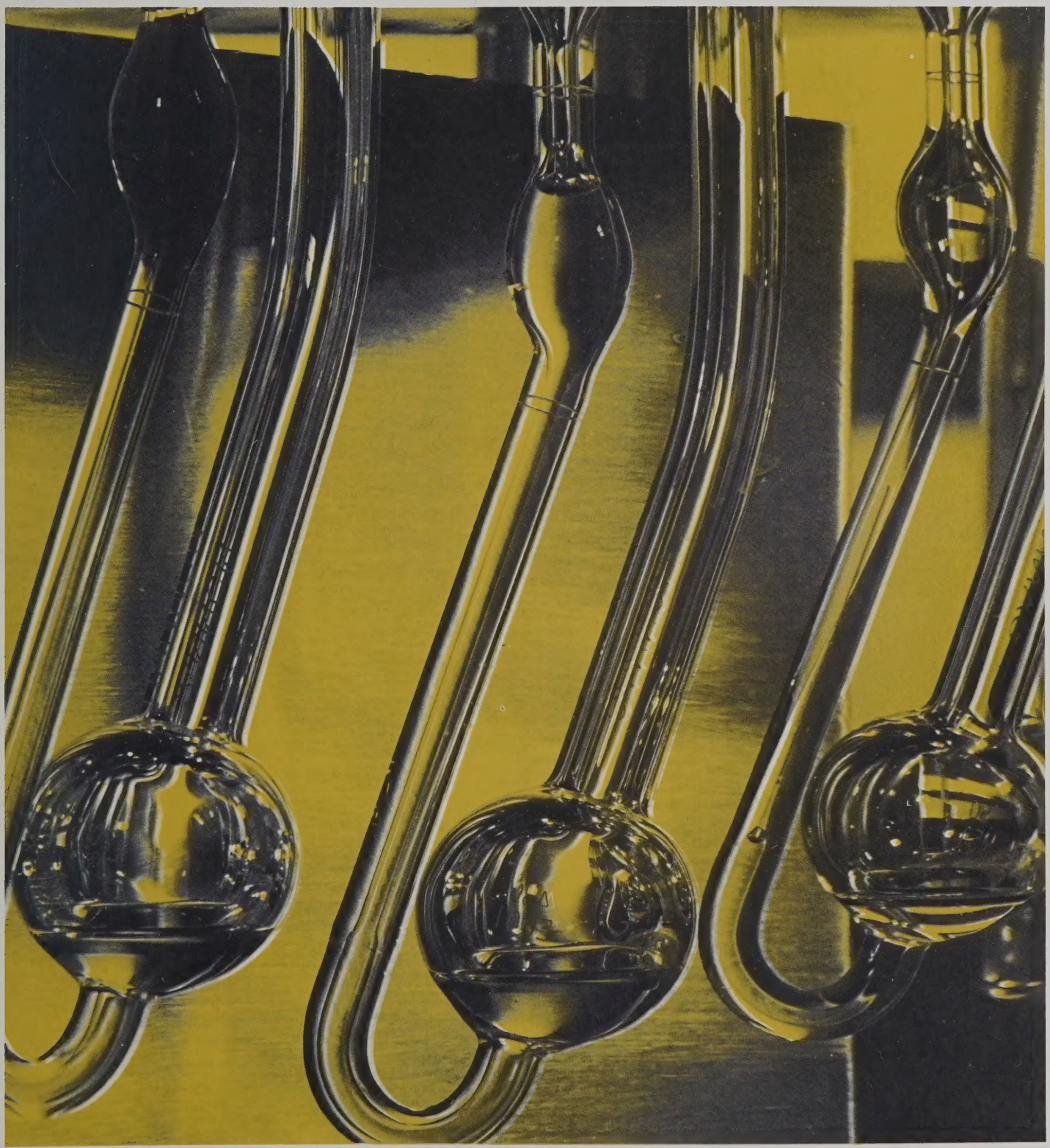
DIMENSIONS NBS

The magazine of the
National Bureau
of Standards
U.S. Department
of Commerce

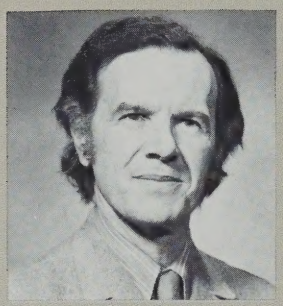
June 1977



RECYCLING OIL. See page 8.

COMMENT

FOCUSING ON STATE AND LOCAL GOVERNMENTS



In recent months there has been a real surge of interest in shaping federal programs to meet the needs of state and local governments. It was a campaign promise of President Carter and steps to follow through were apparent even before the Inauguration. Secretary Juanita Kreps of the Department of Commerce and a number of other cabinet-level appointees met with committees of the U.S. Conference of Mayors just before the Inauguration and with the National League of Cities and the National Association of Counties in subsequent months. The message has been repeated: "We're listening" and "We care."

President Carter, in a widely circulated memorandum, on February 25 asked each Department head to be sure the programs of this administration are developed in genuine and timely consultation with the state and local government leaders who must play such an important role in implementing them.

Does this apply to research and development as well as other programs? The answer came in no uncertain terms on March 25 when Dr. Frank Press, the President's new Science Advisor and Director of the Office of Science and Technology Policy (OSTP), met for the first time with one of the two permanent committees of OSTP—the Intergovernmental Science, Engineering, and Technology Advisory Panel (ISETAP). Governor George Busbee of Georgia, the vice-chairman of the panel, was there to welcome Bert Lance, the director of the Office of Management and Budget, and Jack Watson, special assistant to the President for intergovernmental relations and secretary to the Cabinet. There was general agreement that President Carter's memorandum calling for effective consultation was most germane to the panel's task of improving the application of federal science and technology to the problems of state and local governments.

Ted Tedesco, city manager of San Jose, California, and chairman of ISETAP's Processes Task Force, called for a number of steps to improve the interactions with the federal government on this front. Among them were recommendations for increased use of the Intergovernmental Personnel Act to provide opportunities for high caliber state, local, and federal officials to work with other levels of government.

The National Bureau of Standards is launching this month an Intergovernmental Personnel Exchange Program for state and local government employees. It will also extend to employees of the academic and public interest groups that serve state and local governments. Patterned after the Industrial Research Associate Program which has a long record of achievement at NBS, the new program will provide opportunities for qualified state and local participants to tackle significant technical problems in partnership with NBS professionals. The specialized areas of such studies can be as wide or as deep as the Bureau's programs. A detailed brochure is available on request from A402 Administration Building, National Bureau of Standards, Washington, D.C. 20234.

NBS has provided technical support and information for state and local activities almost since its birth and has many such programs now, often working through lead agencies. The resurgence of interest in these other levels of government provides a new challenge to the ingenuity of the NBS staff and a new opportunity for our many colleagues in state and local governments. We welcome your suggestions on how to make this partnership work.

James M. Wyckoff

James M. Wyckoff
Liaison Officer
State and Local Governmental Affairs

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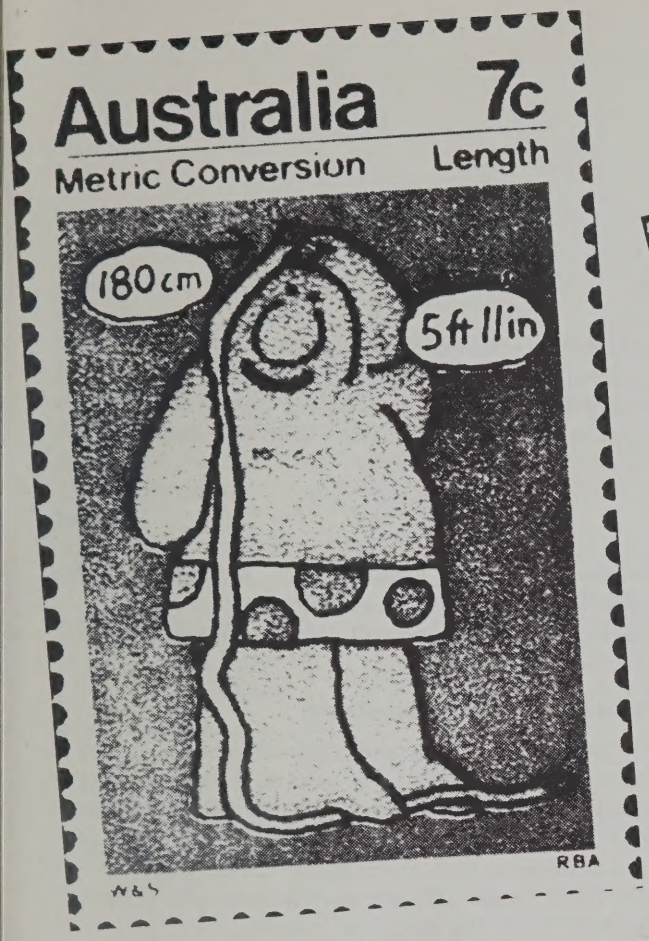
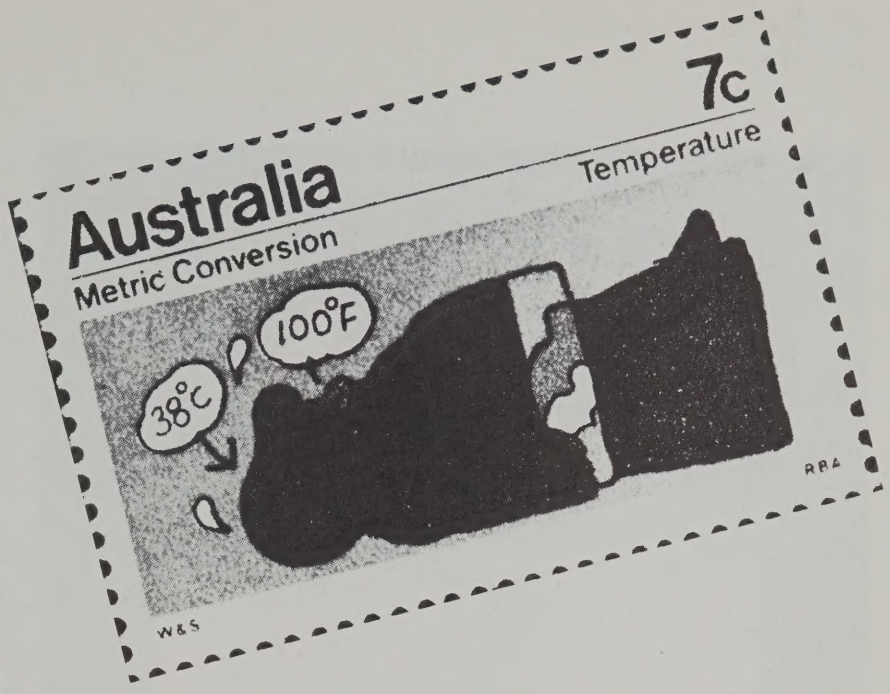




by Hans J. Milton

IT is one of the paradoxes of history that the United States, the first nation to introduce a system of decimal currency in the late eighteenth century, will also be the last major nation to make the switch to a decimal system of measurement—SI—towards the latter part of the twentieth century.

While this belated start is not without costs or problems, there are at least two significant advantages:

- the change from the outdated to the most modern system of measurement, SI, can be made in a single step;
- the successes and failures of those who have already gone metric indicate where to concentrate effort, simplify, speed up, and most importantly, where to beware.

In this article, I will endeavor to give metrication —the change to SI—a perspective gained from the Australian experience. Australia made the change to SI a national goal for the 1970s and this year has substantially achieved that goal.

While many facets of metrication can be studied, I will concentrate on a few significant metric lessons which can assist the United States in efficient metrication.

Milton is Assistant Secretary for Housing Research in the Australian Government Service, on loan to the NBS Center for Building Technology as a technical consultant on metrication and associated issues.

The Australian Experience as a Guide

Australia has proved that metrication need not be feared but should be welcomed like a breath of fresh air. Those who participated in the Australian changeover are proud of the voluntary, coordinated, and national approach to the challenge of change, during which many opportunities were pinpointed and forcefully pursued.

The necessary changes were carefully planned and efficiently carried out. Most of the anticipated problems failed to materialize. The coordinated program of metrication turned out to be much cheaper and less time consuming than first predicted, probably because of the human tendency to over estimate time and costs in untried fields.

The significant lesson from Australia, however, is that metrication must be treated as a "management exercise with technical overtones." It requires positive management action based on executive commitment, community wide cooperation, and preferably leadership from the public sector (federal, state, and local government) to give momentum to the change. We Australians found that the best approach to metrication was one which built up simultaneous involvement of the community in all areas, so that exposure to metric was continually intensified. Short-term sacrifices were made to achieve long-term goals. This approach demands thorough research and analysis before any action, and sets deadlines for the action to be completed.

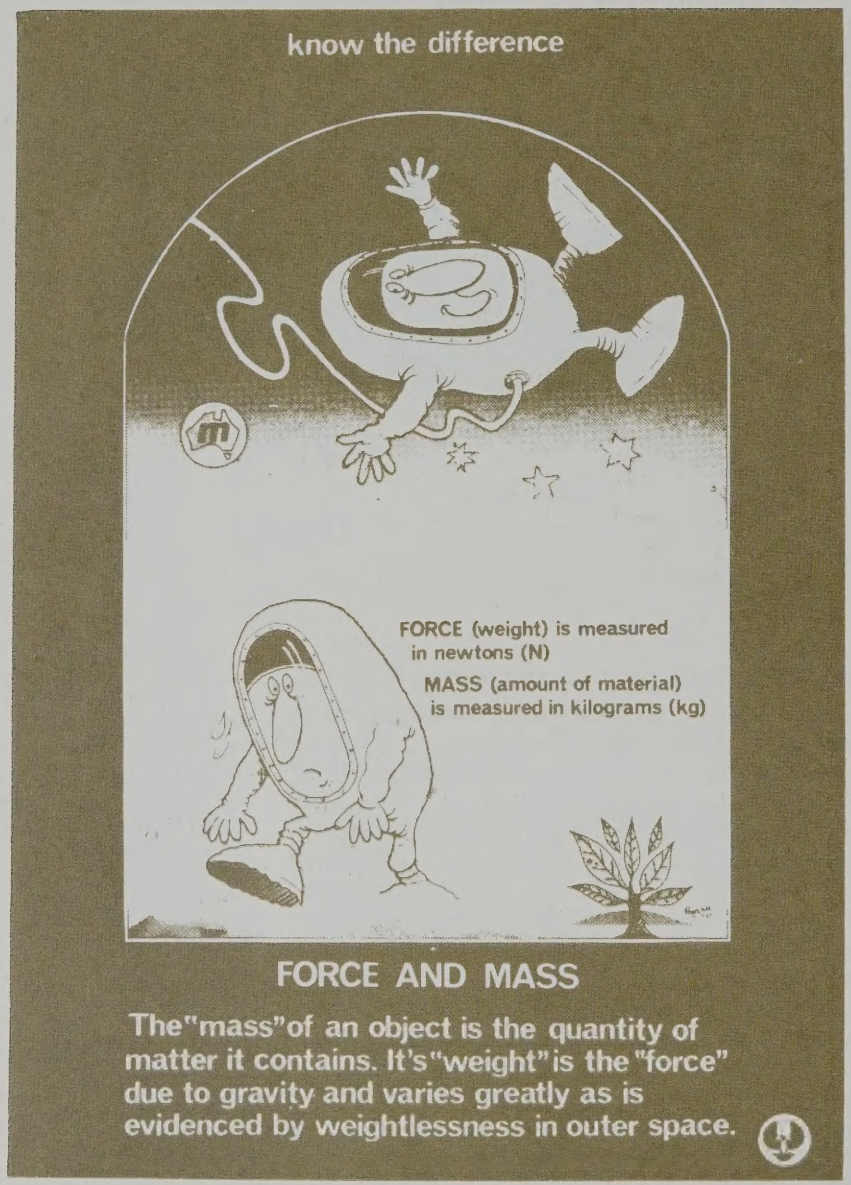
The Australian industry wisely adopted the motto "Rationalization Through Metrication" and all parties were counselled to forget the past and concentrate on future opportunities.

Metrication Is Easier Than Most People Imagine

People are the key to effective metrication. They

turn page

Controversy always accompanies change, and with the metric changeover, disputes can take on a national flavor. Americans are still quibbling over the spelling of meter. The Aussies found nothing to disagree about in this matter, which is metre to them. But cries of outrage arose when a blobby, sometimes beer-swilling or sweating bloke appeared on the scene to promote metrication on a series of Australian stamps. One Sydney resident responded to the protests by asking, "Are we afraid to let the world know that we have a sense of humor—that Australians drink beer, sweat when it's hot, and that many are inclined to blobbiness?"



must offer positive support and commitment to the change. To some extent, of course, all of us resist change, but many of the people who oppose metrication know little about SI. They are usually unaware that:

a. a large number of SI units are already in common use. Typical examples include the base units second, ampere, and candela, and the derived units watt, volt, ohm, farad, coulomb, and lumen.

b. SI has far fewer units than the customary system. For example, one unit of length, the meter (m) and its decimally related multiples and submultiples such as the kilometer (km) and millimeter (mm), will replace such a variety of traditional units as the mile, furlong, chain, link, rod (pole), fathom, yard, foot, survey foot, inch, etc.

c. all units within SI are coherent; they relate to each other by a factor of one, so that no multiplication or division occurs when derived units are related back to their constituent base and/or supplementary units in calculations. This is best illustrated by showing the coherent derivation of the customary and international unit for electric potential, the volt (V):

$$1\,V = 1\,\frac{W}{A} = 1\,\frac{J}{s \cdot A} = 1\,\frac{N \cdot m}{s \cdot A} = 1\,\frac{kg \cdot m^2}{s^3 \cdot A}$$

$$\text{or} \qquad 1\,V = 1\,kg \cdot m^2 \cdot s^{-3} \cdot A^{-1}$$

where meter (m), kilogram (kg), second (s) and ampere (A) are all SI base units; and newton (N), joule (J), watt (W), and volt (V) are coherent derived SI units.

SI Is Simpler and International

Internal coherence and decimal prefixes which can be attached to SI units to extend their working range from the sub-atomic (10^{-18}) to the astronomic (10^{18}), provide great simplicity and power. Some of the SI prefixes, such as micro (10^{-6}), milli (10^{-3}), kilo (10^{3}) and mega (10^{6}) are already generally known, particularly in the electrical industry.

Most calculations in SI are less error prone and more accurate—thus saving time and money. Electronic calculators and computers operate more efficiently with SI units. In many activities such as cost estimating, an intrinsically decimal measurement system becomes a natural ally of decimal currency, and this simplifies work considerably.

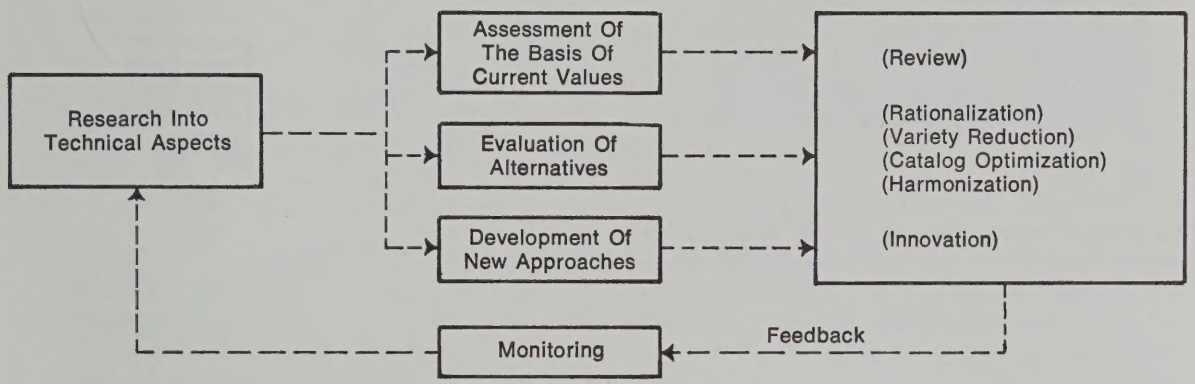
SI is an integral part of modern international science and technology and the measurement language of international standards. Internationally recogized unit and prefix symbols and agreed conventions for presentation and use of SI units and numerical values facilitate the transfer of knowledge between nations.

Metrication Means Change—Change Creates Research Opportunities

While research is normally designed to identify paths for beneficial change and pave the way for such changes, metrication provides the opportunity to review customary values and sizes and to introduce preferred values or rationalized ranges of sizes. It is not merely another way to describe temperature or length. It may be beneficial to the concrete industry and to customers to replace the current range of 7 concrete strength grades between 2000 and 5000 psi with 6, or even 5, preferred metric strength grades, but only in-depth analysis by the industry, designers, and users will show the best solution.

The change to SI represents a chance to harmonize conflicting standards or regulations issued by different authorities and/or community standards groups in the United States. But research is neces-

sary to find the best harmonized values. Since no single traditional value or established benchmark should escape scrutiny when it comes to metrication, the change to SI can be described as the "most significant research opportunity in modern times." Metrication research is illustrated diagrammatically below:

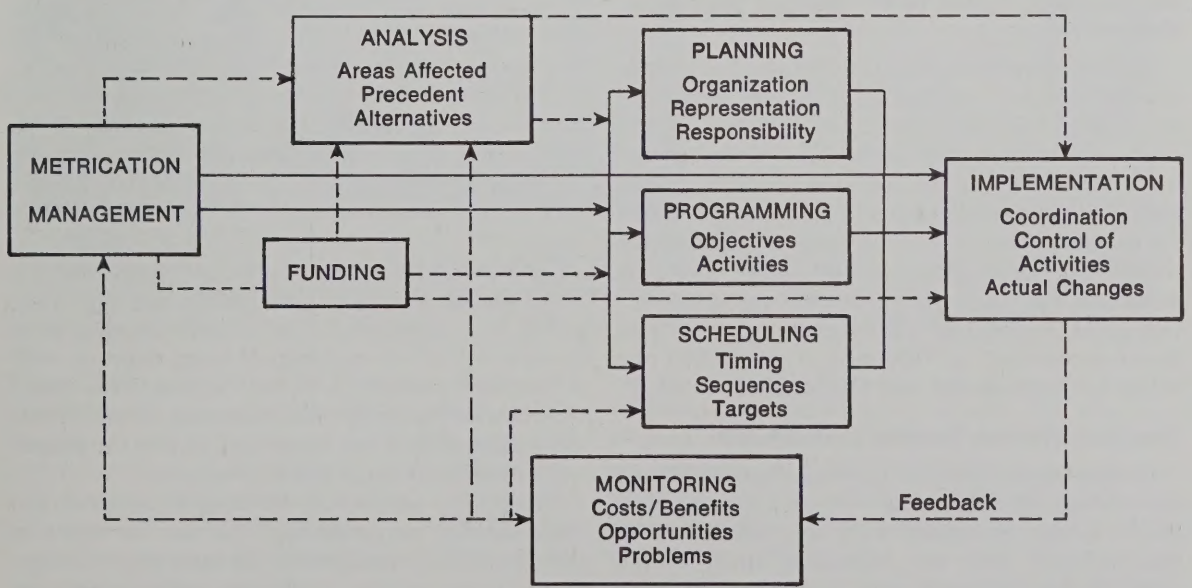


Metrication research ranges from the fairly simple substitution of current values with the most suitable metric equivalent to innovation and development of entirely new data and design aids.

Management, the Motor for Metrication

The change to SI will cost less if properly managed nationally as well as within organizations. To ensure that costs are minimized and opportunities maximized, considerable thought should be given to the selection of an appropriate "metric coordinator" or "director of metrication". A good metric manager will quickly repay his or her cost by being a resource for any questions about metric, and will be saving staff time by identifying opportunities related to metric, providing active participation in metric decisions, and ensuring that the funds allocated to metrication are sensibly spent. A hard-working and knowledgable metric manager is one of the key representatives of an organization during the change to SI.

Management activities are illustrated schematically in the diagram below:



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Preferred Values—Making the Most of Metrication

One major justification for the change to SI is the industrial and commercial opportunity to reduce variety in order to achieve economies in the standardization of scale.

A preferred product range should lead to better quality and inventory control and thus more availability of quality items—benefits that suit the customer as well as the producer and distributor.

We have all experienced the difficulty of making dollar value comparisons in the supermarket when we are confronted with a jumble of packaging quantities. Standardized packages and quantities would benefit the value-conscious consumer and also facilitate handling, transportation, and storage in warehouses, supermarkets, or homes. Metrication holds the key to the development of such uniformity.

In the construction community, previous attempts to coordinate building product sizes with building dimensions through a common fundamental unit of size (or module) and preferred multiples, have met with only limited success. No catalyst existed to bring about "dimensional coordination". The change to SI is a unique opportunity to change to preferred dimensions and sizes—preferably those that have been agreed upon internationally which will give design, production, and construction a common reference framework offering greater accuracy and less waste of materials, labor, and energy.

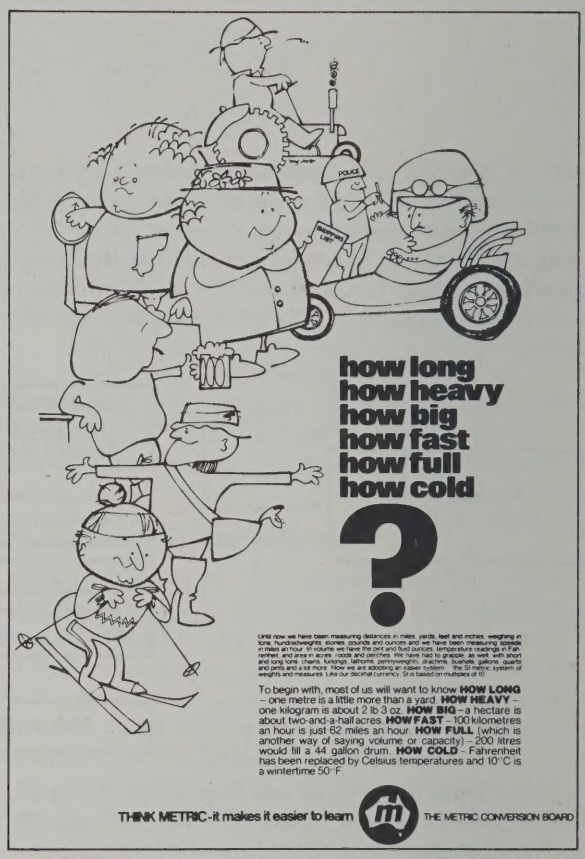
"Comprehensive metric training programs should be reserved for those who train others."

Not Everything Needs To Be Changed Because of Metrication

Another important lesson is that common sense must prevail and metrication should only be carried out where it benefits the community or is cost-effective. There are times when the "ardent decimalists" should be stopped, because a simple, direct conversion of existing values is the "only" solution. For example, it would be foolhardy to advocate the change of the standard railroad gauge from the present 4′ 8½″ to anything but the direct conversion of 1435 mm. The cost of changing to a "preferred dimension" of 1450 mm or even 1500 mm would be astronomical and totally unwarranted.

The Most Effective Training Is on the Job

Comprehensive metric training programs should be reserved for those who will train others. Most people in the community need no more than brief familiarization with the job-related units. Metric units are more readily learned in the work environment where they are directly applied and with the aid of an authoritative reference document on SI usage, people will be ready to tackle any metric job.



The general public will need only a basic working knowledge of the key units for length, area, volume and capacity, mass, and temperature, and these are quickly assimilated.

One's own metric height, mass (weight), or arm length is easily measured and remembered.

Most tradesmen, despite the claims of some unions, need no more than three or four units of measurement in their jobs; these can be learned in a few hours. However, engineers and scientists use a much greater variety of units in their daily tasks, and they will be in the vanguard of those in the community who will work in SI. In fact, it is these groups that already make wide use of the metric system.

The ideal sentinels for correct SI usage are the proof-reader, the editor, the typist, and the typesetter. It is important that all of them receive some general instruction in correct SI usage together with a reference manual on correct SI practices. While they cannot ensure that calculations or values shown are accurate, they can scrutinize the text for proper use of units, symbols, and punctuation.

Metrication can be fun, provided people look for opportunities not problems. The key to effective metrification is management, because only management can ensure that predictions and proposals are

MCB NEWSLETTER

VOL. 1, No. 10 THE OFFICIAL ORGAN OF THE METRIC CONVERSION BOARD AUGUST 1972

JULY '73 TARGET FOR FREIGHT RATE SWITCH

The Federal Minister for Education and Science, Mr Malcolm Fraser, has accepted 1 July 1973 as the target date for conversion to metric units of freight forwarding rates for air, road, rail and sea transport.

Mr Fraser's acceptance followed the Metric Conversion Board's approval of a program developed by a Panel made up of nominees from all areas of the freight forwarding industry.

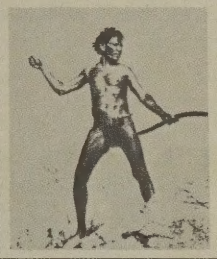
The Panel decided that freight rate schedules should be converted on a common date to avoid confusion as freight is transferred from one form of transport to another. The target date 1 July 1973 was determined after taking into account the anticipated volume of goods produced in metric measurements which the industry will be required to handle by then.

The proposed date has been supported by the industries concerned and has been agreed to by all Railways Commissioners.

The Panel, in its recommendations, pointed out that the road transport and storage industries have already formulated their conversion programs, and stressed the desirability of co-ordinating those programs with the freight forwarding program.

Units for freight forwarding have been chosen as the metre, square-metre, cubic metre, litre, kilogram and tonne. Freight charges based on 1 kg increments will be used in most cases, though provision for 0·5 kg increments for air transport may be required. With regard to volume, increments of 0·01 m³ should be suitable in most instances.

Boomerangs soar into '70s



A boomerang thrower from Bowna, near Albury, recently claimed a new world record for distance throwing.

Jeff Lewry threw his boomerang 82 metres before it returned, breaking his own record of 85½ yards set two years ago. Eighty-two metres is about four metres more than 85½ yards.

An official of the Boomerang Association of Australia explained that boomerang-throwing changed over to the metric system in April.

Left: Aboriginal kangaroo-hunting

N.Z. head calls for trans-Tasman trade

Mr Stevenson (centre) with Senior Project Officers Mr P. J. O'Neill (left) and Mr W. H. Broadbridge.

New Zealand would have to work hard to keep pace with Australia's progress towards conversion, Chairman of New Zealand's Metric Advisory Board Mr I. D. Stevenson said recently at the conclusion of a week-long round of talks in Sydney with senior members of the Metric Conversion Board.

"Industries and other interests appear to very well served by the Board," Mr Stevenson said. "Very close liaison has been established."

He added that he was glad he did not have to contend with the Federal-State division of responsibility that exists in Australia. "I am in a position to get closer to people much more quickly than I would be if I had to work through channels of communication existing in Australia."

Mr Stevenson said there was an increasing need for members of the Commonwealth to be self sufficient as Britain moved towards Europe. "New Zealand will look to her bigger sister nation for help and, in particular, I hope that we can so arrange our conversion programs that there will be no artificial barriers to trade across the Tasman."

YOU MAY REPRINT

Metric packaging of sugar in all States

A change in industrial sugar packaging, from 70 lb to 30 kg bags, took effect for deliveries in all States except Western Australia from the beginning of July 1972. Metric packaging in WA will commence at the beginning of October 1972.

Pricings for the new 30 kg bags were determined by the Sugar Board in accordance with the Sugar Agreement 1969 between Queensland and the Commonwealth. The agreement sets out prices per imperial ton which have remained unchanged since June 1967.

Unit prices for each grade of sugar packed in 30 kg bags were calculated by the Sugar Board directly from the imperial ton prices.

A purchaser of sugar may buy for cash direct from CSR in quantities of ½ ton (seventeen 30 kg bags) or more at the unit prices determined by the Sugar Board.

Alternatively, a purchaser may buy from a listed sugar wholesaler. Most customers prefer to deal through a wholesaler because of the additional services provided, to cover the cost of which a small mark-up is added.

Wholesalers' prices for sugar in 70 lb bags have always varied and, presumably, will continue to do so for the 30 kg bag.

Retail sugar packages marketed by CSR will be converted in the latter part of 1972. Metric packages of 1A grade white sugar were available first in Victoria. Caster sugar, soft brown sugar, sugar cubes and coffee sugar crystal packages will change to metric weights progressively from October.

In other States conversion of retail sugar packs will follow a similar pattern. Metric 1A sugar packages will be available in Tasmania in mid-September, in South Australia and Western Australia in October, and in Queensland and New South Wales in November. All retail sugar lines except golden syrup and treacle are expected to be available in metric sizes by the end of 1972. Golden syrup and treacle tins will be packed in metric sizes in 1973. All new metric packages will be clearly marked with the approved metric symbol.

The 2 lb and 4 lb 1A sugar packs will be replaced by 1 kg (2·2 lb) and 2 kg (4·4 lb) packs respectively. A notice on the back panel of each package will state that the package contains 10 per cent more sugar than the imperial weight pack it replaces.

The 32 lb parcel of retail 1A packages will be replaced by a 16 kg parcel. Each 16 kg parcel will contain either 16 x 1 kg packages or 8 x 2 kg packages.

Retail sugar prices are not fixed by statute and vary in accordance with the practice of individual retailers.

THOUSANDS VISIT BRISBANE EXHIBITION

An estimated 25 000 people were weighed in kilograms and measured in centimetres at the recent Royal National Show at Brisbane. The Metric Conversion Board chose the show for its first major public display. Visitors' measurements were recorded for them on a card which also carried information on the Celsius temperature scale. Colourful posters set out information likely to be of most use to people in their everyday lives. Space was made available to the Board by the Division of Occupational Safety of the Department of Industrial Affairs, and scales by the Avery organisation. In response to requests, further public displays will take place at the Perth and Adelaide Royal Shows, the Standards Association of Australia's Jubilee Exhibition at Sydney and Melbourne, and a number of country centres.

MCB's debt

The development of the building and construction conversion program owed much to the "help, advice and guidance so generously given over the past two years" by Sir Albert Jennings.

Chairman of the Metric Conversion Board Mr J. D. Norgard said this following Sir Albert's recent retirement from the Board. Sir Albert was Chairman of the Building and Construction Advisory Committee.

Sir Albert

"It was largely due to your efforts in assembling such a strong and vigorous team on the various Building and Construction Committees of the Board that the program for this important sector of industry was determined so early — in fact it was the first of the industrial programs to be approved — and has now entered the implementation stage," Mr Norgard said.

turned into reality. It can be forecast with certainty that 1977 will become an important metric date—the year in which the United States will cease drift into metrication and establish a well planned national approach in which all parties cooperate and coordinate their activities to bring about the change to SI. The Metric Conversion Act of 1975 has set the stage for these actions.

So, what about you and me? We can be metrically curious and use metric measuring tape devices to measure some everyday objects. We can purchase a metric kitchen scale to see what "masses" we consume, or a bathroom scale to measure our body mass; or we can set up a Celsius thermometer. There may even be some surprises in store. Did you notice, for instance, that the cover illustration of this magazine has a width and height of 200 mm, or 20 cm, or 0.2 m? □

RECYCLING OIL: A QUESTION OF QUALITY

The Association of Petroleum Re-refiners is supporting an Industrial Research Associate, Robert Pedall, to work at NBS. At left, Pedall determines viscosity, a property of recycled oils.

by Madeleine Jacobs

IF you own an automobile, you have probably seen oil being drained out of your car at your service station. Or, perhaps you're one of the increasing number of motorists who change their own oil. This simple procedure, repeated periodically for every motor vehicle on U.S. highways, produces used oil at the rate of more than 14 million barrels a year, according to the Environmental Protection Agency (EPA). And, nearly 12 million barrels are added by industrial, aviation, and other uses.

What happens to this oil? Do-it-yourselfers and even some service station owners often simply dump it in their back yards or down the sewers. Collectors retrieve some of it from gas stations and manufacturing plants, often using it to oil roads to keep down the dust, or mixing it with virgin fuel oil for burning. Much waste oil ends up in landfills and rivers, where it can create a serious environmental hazard.

The question is, can something better be done with this material to make it reusable? Can it be recycled and used over and over again so that instead of polluting the environment it can actually be beneficial to the economy and to the country as a whole? From a technological point of view, the answer is yes. After the sludge, water, and other contaminants are removed from used oil, what remains is a satisfactory basestock product. With the proper additives mixed in, recycled lubricating oil, for example, can apparently be as good as many virgin oils on the market, according to many experts in the lubricating field. Reusing wastes in this and other ways could reduce petroleum imports by about 70,000 barrels a day, or 25.5 million barrels a year, says the Federal Energy Administration (FEA). Yet, only a tiny fraction of the used oil is currently re-refined.

Recognizing both the environmental advantage and the energy potential of recycling, Congress passed the Energy Policy and Conservation Act of 1975 (Public Law 94-163). This law directs the National Bureau of Standards (NBS) to develop test procedures which can be used to establish the "substantial equivalency" of recycled oil with virgin oil for each potential end use. These test procedures will be provided to the Federal Trade Commission (FTC), and the FTC will then remove certain labeling requirements for recycled oils which can pass the tests, placing them in a stronger competitive position in the marketplace.

NBS research chemist Jack Comeford removes sample from furnace used in test to determine ash content of recycled oil.

The question of quality is one of the principal barriers to increased oil recycling, explains Donald Becker, manager of the NBS Recycled Oil Program. "Currently, the FTC requires products that are made from used oil to be labeled 'made from previously used oil,' " Becker explains. These labeling requirements were instituted by the FTC to counteract inferior-quality products being put out by some oil recyclers in the 1940's and 1950's. "These products have largely been eliminated, but the doubt still lingers in some peoples' minds and they simply won't buy recycled oil, even where it is available," he says.

The fact is, recycled oil is not available in many parts of the country, although the re-refining industry dates back to 1915. Prior to 1965, there were more than 150 re-refiners; today there are only 30 or so companies. The reduced number of re-refining companies has been the result of several problems, according to an EPA study. One is the question of quality, which NBS is working on. Another is the lack of used oil feedstock for re-refining because the oils are disposed of in so many different ways. One of the greatest challenges is collecting a large quantity of the used oil in an economical manner. Another problem that affected the oil recycling industry, according to EPA, was a 1965 change in the tax law for off-highway use of lubricating oil which put re-refiners at a financial disadvantage. This law permitted a rebate of excise taxes on 100 percent virgin oil products without permitting a rebate of taxes on virgin oil blended with reprocessed products.

turn page

Jacobs is a writer and public information specialist in the NBS Office of Information Activities.

Vials of recycled oil at left show range of color, which may or may not be an indication of quality. At right, Comeford uses infrared spectroscopy to study additives that may be present in recycled oil.

"Recycling waste oil could reduce petroleum imports by about 25.5 million barrels a year."

The Energy Policy and Conservation Act calls for revised policies to encourage procurement of recycled oil for military and nonmilitary federal uses. This means the federal government has a direct interest in assuring quality in these oils, both for itself and for consumers in general. The Act covers many different kinds of mineral oils for a variety of end-use products, such as industrial, metal-working and hydraulic oils, and oils used as fuel and in engines—both in the crankcase and in the transmission. Each of these categories has one or more individual sets of specifications, test procedures, and technical problems. In addition, each category consists of different types. For example, fuel oil has six grades, and there are many types of industrial and hydraulic oils that are widely used. All petroleum-based oils which can be recycled are covered by the law.

Says Becker, "In short, we're faced with an extremely complicated task. What we're being asked to do, in effect, is to provide test procedures that can be used to determine if a recycled oil for a particular end use is as good as the virgin product."

Used Oil as Fuel

The first task being addressed in the NBS program is a set of test procedures for used oil to be recycled and furnished as fuel oil. Ideally, a high-quality lubricating oil should be recycled back into a high-quality product for use as a lubricant. The same is true for each category of oil. But when re-refining facilities are not available or when there's not enough volume to make re-refining economically feasible, then burning the oil to provide recovery of the heat content is a valid application, Becker believes.

"One of the main reasons we're looking at fuel oil first is that burning is currently the largest volume end use of used lubricating oils," he says. "About 50 percent of the used oil generated in the country is burned, both with and without suitable environmental controls. There appears to be a considerable environmental hazard with the uncontrolled burning of waste oils due to heavy metals in used motor oil as well as the lead from gasoline that gets into the oil. Thus, we felt that this was an important area where we could make a contribution toward improving the environment in a relatively short period of time."

The NBS Recycled Oil Program is built around the fact that there are already a large number of test methods and specifications in existence for petroleum products, including those from the American Society for Testing and Materials (ASTM), from

industry, and from military and nonmilitary federal agencies.

Says Becker, "There are about 20 applicable test procedures that are currently being used to specify virgin fuel oils, but apparently no one has evaluated whether they are valid for specifying fuel oil made from used oil. We are looking at these methods to see if they need to be modified or if new methods need to be developed to adequately characterize these recycled products. It may turn out that the properties of recycled oil are such that new methods will be necessary. So, first we'll be trying to establish the properties which are both necessary and sufficient to establish the substantial equivalency of the oil, and then we'll provide the FTC with a set of test procedures which are capable of verifying this equivalency."

Above, NBS Acting Director Ernest Ambler tells workshop attendees meeting to discuss problems of recycled oils that "used oil released into the environment is not only an economic waste, but is now a pollutant endangering the citizens of this nation."

At left, Donald Becker, manager of NBS Recycled Oil Program, describes NBS efforts to meeting attendees.

The work under Becker's direction is being carried out by a number of scientists in the technical divisions of the Institute for Materials Research, with statistical support from the Applied Mathematics Division of the Institute for Basic Standards. "Among the specific questions we're looking at are what happens to the heavy metal contaminants from the gasoline and additives when recycled fuel oil is burned, and what their chemical forms are, both before and after combustion," Becker says. "Inorganic constituents such as heavy metals do not biodegrade or burn, they just change chemical form, perhaps, and come out as 'something else.' This 'something else' could be completely harmless or could be highly toxic. An example is the mercury situation of a few years ago. It was thought that the mercury from industrial wastes was just falling to the bottom of the rivers and lakes. Unfortunately, much of the relatively harmless inorganic mercury was changed by microbial action into 'something else,' in this case the highly toxic organometallic compound, methylmercury."

The NBS researchers are also looking at the polynuclear aromatic hydrocarbons (PNA's) found in used and re-refined lubricating oils. Explains Becker, "Some of these PNA's are reported to be carcinogenic chemical compounds, and we're trying to

turn page

learn more about their presence in used oil. A recent report indicated that very high concentrations of these compounds were formed in engines and concentrated in the used lubricating oil. We need more data to determine how important this is."

Recycled Motor Oil

From the fuel oil area, the program will move on to re-refined motor oil which is suitable for use in automobiles and other vehicles. Of all used oils, establishing the equivalency of motor oils recycled back into motor oils promises to be the toughest problem.

The reasons for this can be seen by considering the tests that are currently used to determine the quality of oil for automobiles. When a consumer buys lubricating oil from a service station or auto supply store, he will usually see an "SE" mark somewhere on the container. This American Petroleum Institute (API) classification symbol means the oil is believed to be capable of passing the so-called "engine sequence tests"—a set of engine tests devised by the ASTM, the API, and the Society of Automotive Engineers. In these evaluations, the gasoline or diesel engine is mounted on a laboratory test stand and operated for a prescribed period of time under standard conditions. As many variables as possible are controlled in the test, including the use of a standard fuel.

For example, one particular engine sequence test runs for 196 hours. The engine is then totally dismantled and inspected by certified raters who rate it for the particular characteristics being studied. One sequence may evaluate rusting and corrosion, another oil thickening and oxidation, and still another sludge and varnish deposits. These procedures are costly—about $18,000 for a complete set to evaluate a gasoline engine oil.

In fact, refiners usually fully recheck the oil only when they change their additive formula or their source of crude supply. Military specifications require retesting of an approved oil at least once every four years. On the other hand, some people feel that every single batch of oil processed by a re-refiner has a different composition, and, therefore, each batch would require these expensive tests in order to receive an SE rating. This obviously would be very costly. Of course, the real test of an oil is how well it performs in actual operation, and re-refiners and many of their customers say the product performs well. Solving the problem of equivalency, either with alternatives to engine sequence tests as a measure of quality—which has

Varying viewpoints on problems with oil recycling were expressed at the first NBS Meeting on Measurements and Standards for Recycled Oil. A second conference will be held November 29 and 30, 1977.

NBS scientists will study whether existing test methods for virgin oils, such as the sulfated ash technique shown here, are valid for recycled oils.

been an unrealized goal for more than 20 years—or with some other way to monitor quality effectively between engine sequence tests, will be the most difficult part of the NBS program.

Becker says that this second possibility, monitoring quality between engine sequence tests, appears to have the best chance for success. "There are several studies, for instance, that show the used engine crankcase oil is fairly consistent in what it contains, regardless of where it comes from in the country or at what time of the year it is collected," he points out. "Much more data are required to substantiate this, but if it turns out to be true, it may be a matter of segregating collected used oil to keep the crankcase oils apart from other types of oils and then establishing a series of simpler tests to verify that an effective re-refining job has been done."

Cooperation with Others

NBS has also been working closely with other organizations involved in oil recycling and testing, especially the ASTM Committee D-2 on Petroleum and Petroleum Products, the Bartlesville Energy Research Center (Energy Research and Development Administration), the Office of Solid Waste Management of the Environmental Protection Agency, and the U.S. Army Fuel and Lubricants Laboratory.

"Our early efforts were aimed at gathering information about existing problems and reviewing and evaluating existing test methods for petroleum products," Becker says. "We held numerous meetings with representatives from the virgin oil refining industry, the used oil re-refining industry, automobile and manufacturing industries, trade associations, standards organizations, and other federal agencies with existing used oil programs. They were all most helpful and cooperative."

NBS also sponsored a workshop attended by 70 experts from these groups. During the two days, they discussed user experiences with re-refined oils, the effects of contaminants on existing test methods, and how NBS can develop test methods to establish the substantial equivalency of recycled oils with virgin oils.

"Of all waste oils, recycled motor oils promise to be the toughest problem."

"As a result of this workshop and of our other discussions, there is no doubt in our minds that there is growing interest in oil recycling, not only among government agencies, but among industries as well," Becker says.

He points out that one market research firm estimates that by 1985 some 125 companies will re-refine nearly 20 million barrels of oil yearly with a value of $1 billion. In addition, the Association of Petroleum Re-refiners (APR) is supporting a research associate from their industry to work at NBS during the coming year with scientists in the Recycled Oil Program. Notes APR Executive Director Duane H. Ekedahl: "This is a particularly significant step for this group to take. . .at a time when industry volume is at a low level. I believe it is an indication of how we view the importance of this program to the future of the re-refining industry."

Since recycling waste oil combines energy and resource conservation with environmental protection, it is a concept that can only move forward. Says Becker, "I think it's inevitable that recycled oils are here to stay. This is especially apparent among the individual companies and industries that have to expend considerable amounts of money to obtain large quantities of industrial oils for their in-plant use. In many cases, these companies have tried recycled oils and have found they work very well in their machines. Acceptance by the general public will probably take longer because it depends on getting a larger number of people to agree that a product is good. But, most experts agree that there is no question about the re-refining industry's capability to produce a high-quality lubricating oil." □

WHAT'S THE PASSWORD?

by Helen M. Wood

SINCE before the days of the legendary Ali Baba, secret passwords have given entree to guarded places where only a select few have the right to enter. More than a name, they confirm the identity of an "in crowd" and, ideally, baffle intruders and imposters.

Not surprisingly, passwords have been adapted to a modern purpose: limiting access to computer systems to the few who are authorized users. With the advent of timesharing and other forms of computer networking, the users of one computer system may be scattered over hundreds or even thousands of miles, connected to the computer by remote terminals.

At present, most systems in the government, and all of the commercial timesharing systems, employ passwords to prevent unauthorized use. One password, the Personal Identification Number (PIN), is familiar to many people. It is used in conjunction with a magnetically encoded card at banking terminals. People using remote computers for programming or other such purposes usually enter the password as a part of a "conversation" with the computer. Their dialogue might be similar to the following:

SYSTEM 24: PORT 15
MARCH 17, 1977: 11:00:22
ENTER USER NAME: wood
ENTER USER PASSWORD: sesame
LOGON COMPLETED

Password systems and other automated personal identification techniques—some still under development—are being tested and evaluated by scientists

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Wood is a computer specialist in the NBS Institute for Computer Sciences and Technology.

and engineers in the Institute for Computer Sciences and Technology at the National Bureau of Standards.* The result of this investigation will be published in a Federal Information Processing Standard (FIPS) guideline to assist federal agencies in selecting appropriate personal authentication methods, or combinations of methods, for their computer systems. This publication will supplement the guideline on evaluation of techniques for automated personal identification (FIPS PUB 48) which was published this year.

Use of passwords may seem to be straightforward and in need of little if any further analysis. However, there is much more here than meets the eye! The features of password schemes differ primarily according to selection techniques, lifetime, and content.

Selection

Passwords may be chosen by the user or assigned by someone else. Those that are user-selected are usually less secure because people tend to pick words or numbers that have some personal meaning (such as birthday, child's name, initials) and consequently are easy to guess. Of course, the primary advantage of a user-chosen password is ease of recall.

Passwords may be assigned to users by the system security officer or by the computer system itself. Although these are generally more secure than user-selected codes, the benefits of assigned passwords may be nullified if they are written down by the user, taken from a master list which is discovered, or generated by an algorithm (code) that is deducible.

In an effort to make computer-assigned passwords easier to remember, one system currently in use by the Air Force generates pronounceable passwords. Although English rules of pronunciation are used, most words created by the computer cannot be found in the dictionary. Some typical words generated are TENORT, RIJACAS, and FLECKY.

Lifetime

The length of time that a password remains in effect is called its lifetime or period. Current schemes allow selected or assigned passwords to be used for an indefinite period of time, for fixed intervals (such as one month), or for a single use only.

Passwords that remain in effect indefinitely are the most vulnerable to discovery through guessing or exhaustive testing. Vulnerability is minimized by techniques such as making the password appropriately long, limiting a single attempt to "log-on" to a computer to set number of consecutive tries, and enforcing time delays between log-on attempts. Time delays can be especially effective at thwarting attempts in which other computers are programmed to call a computer and try to discover a user's password. Such computers could usually try many dif-

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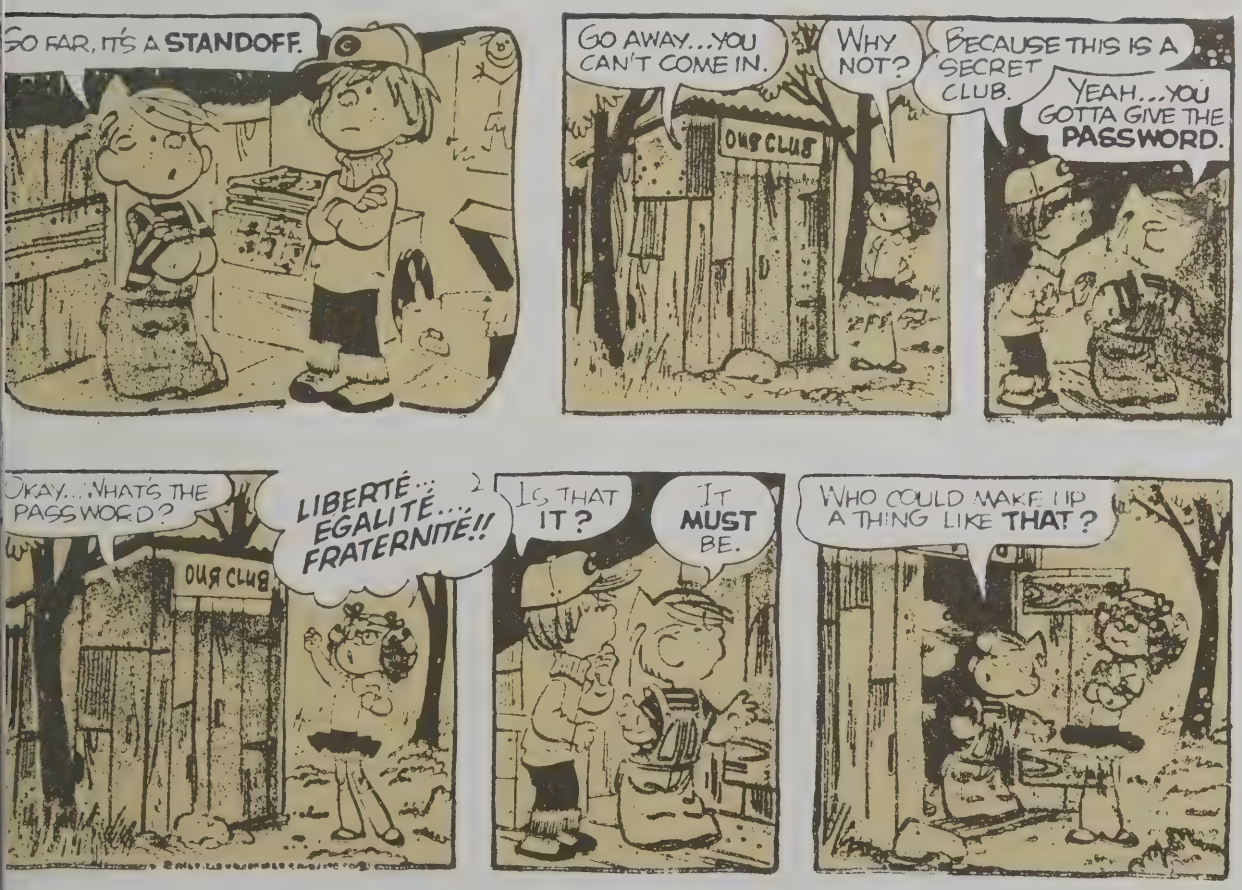
*See DIMENSIONS/NBS, January 1977, page 3. Other techniques include fingerprint, voice, and signature verification systems. See also "The Use of Passwords for Controlled Access to Computer Resources," NBS SP 500-9.



ferent combinations of letters and numbers each minute. However, if several minutes must pass between log-on attempts, then the computer's speed advantage is nullified.

Another shortcoming of passwords with indefinite lifetimes is the difficulty in detecting a successful compromise of the password. Some systems prohibit a user from being logged onto a system from more than one terminal at a time. However, the odds of an imposter and the legitimate user attempting to use the computer at the same time depend upon the frequency and time-of-day that each uses the computer. Thus, when fixed passwords of indefinite lifetime are employed, a masquerader can penetrate an authorized user's files over a long period of time with a low probability of detection.

Usually, the more frequently the password is changed, the better the protection provided. However, if assignments change too often, the user is tempted to write each new one down, creating a new area of vulnerability.

"One-time" passwords are valid for a single use only. Thus, every time a user calls a remote computer and enters his or her current password, that password expires. A new password must then be used at the next terminal session.

Some people have suggested that magnetic-stripe cards, similar to banking transaction cards, be used to store one-time passwords. It can be expensive, however, to equip every terminal with a magnetic card reader/writer—especially if the number of terminals in use is large. Obviously, cost and convenience trade-offs must be weighed against the increase in protection.

"Carefully designed and implemented password techniques are literally a good buy."

Content

A password's content includes its size, makeup (that is, the "alphabet" from which it is made), and any additional information provided by that password. The number of different passwords possible in a given scheme is called the password space. The Personal Identification Number (PIN) used by many banks is typically a four-to-six digit number. Some computer systems accept passwords of eight or more characters and permit numbers, letters, and special characters.

Once password length is selected for a particular computer system, password space depends on the number of valid combinations. Consider, for example, five-character passwords created by the pronounceable password scheme already described. The maximum number of eight-character passwords that can be formed from the English alphabet of 26 characters is 2.1×10^{11}; however, the true password space is considerably less since only those passwords deemed pronounceable are constructed by the computer (about 5.54×10^9 words).

A system using passwords that carry information other than personal authentication has been developed by the University of western Ontario. In this system, the user first enters a user number and conventional password. He or she then indicates the data to be worked with. At that point a second password, associated with that set of data, must be entered. This password indicates (1) whether or not this person can access the data. (2) what portion of the data can be accessed, and (3) what actions the user is authorized to take (for example, reading, modifying, or deleting data).

More information can be included in a password system to further enhance its effectiveness as an identity check. One interesting technique involves the user and the computer in a brief question-answer session. The computer asks several questions in random order. The user's answers must correspond to those on file. Such a dialogue may look like this:

ENTER USER NAME: wood
NAME OF CAT: ralph
ASTROLOGICAL SIGN: scorpio
FAVORITE SPORT: tennis

This is analogous to having several passwords, any number of which may be requested in any order.

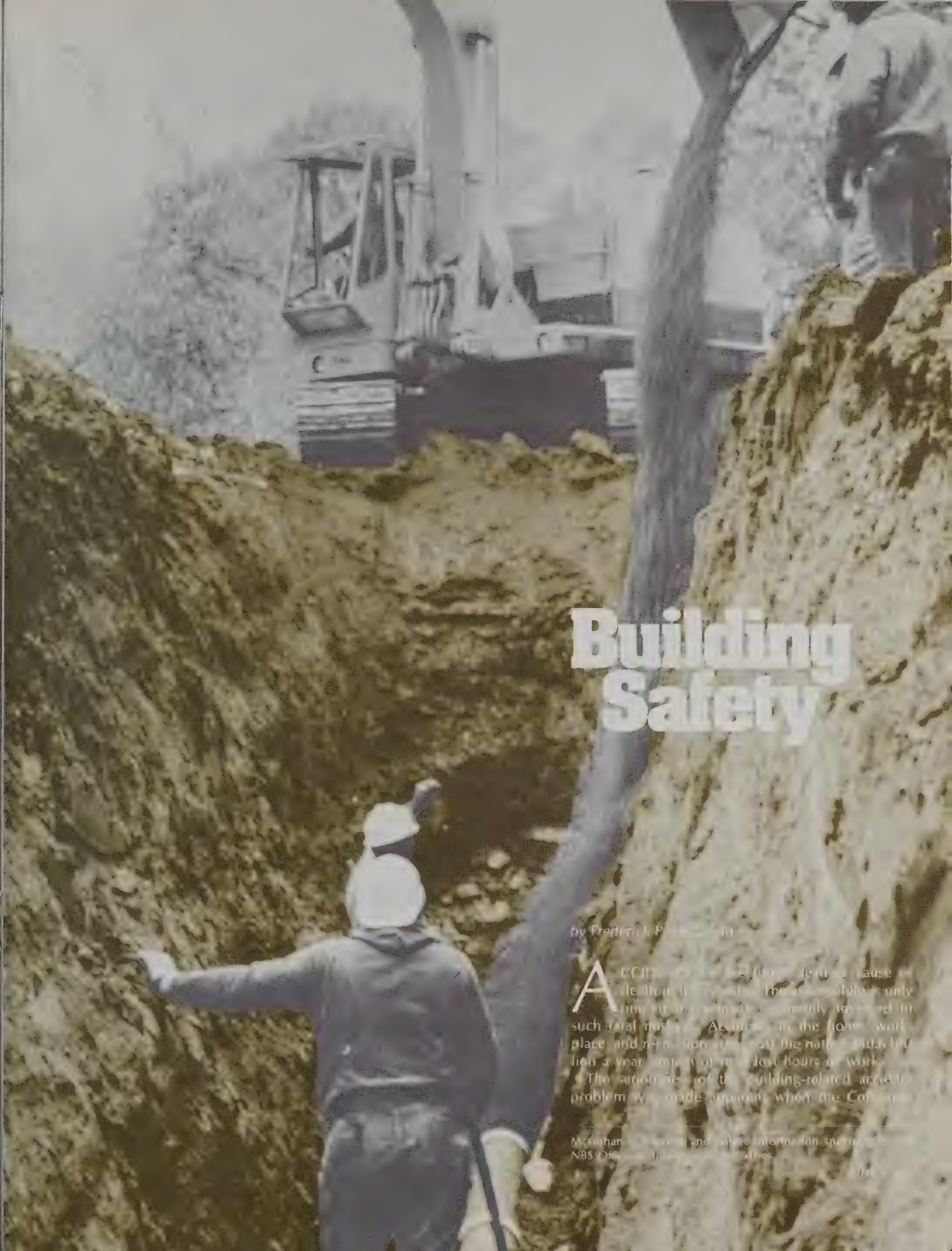
Regardless of which technique is involved, protection of the password is vital. In some systems "one-way" ciphers are used to protect user passwords in storage. These are encryption techniques for which no simple deciphering algorithm exists. In such a scheme, the user's password is encrypted as soon as it is received by the system, and the transformed password is then compared with the encoded table entry. Thus, if a user should accidentally or intentionly discover the passwords in storage, they would be of little use to him.

Likewise, precautions should be taken during transmission between the computer and the terminal. Data encryption can be effective for this purpose. Optimal protection of the transmitted password can be provided if the communications link is encrypted during the entire conversation. The new Data Encryption Standard developed by NBS is suitable for this purpose.*

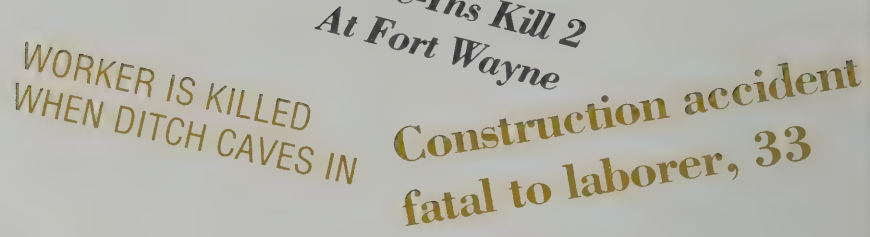
It is apparent that a password should be difficult to guess, easy for the owner to remember, frequently changed, and well protected. However, the exact password scheme appropriate for a given computer system depends upon the security requirements of that system as determined by a cost-risk analysis. This requires consideration of potential threats, the probability of these threats occurring, and the expected losses resulting from a successful penetration of the system versus the cost of providing data protection.

Carefully designed and implemented password techniques are literally a good buy. They are appropriate for use with many systems, and they cost less than most of the other methods for verifying identity. It's safe to say that this ancient method will not outlive its usefulness for some time. □

* This standard is discussed in the February 1977 issue of DIMENSIONS/NBS.



Building Safety



Product Safety Commission (CPSC) and the Occupational Safety and Health Administration (OSHA) came into being in the early 1970's. These separate federal agencies began gathering statistics on accidents and on hazardous products.

Bicycles were at the top of CPSC's listing of hazardous products. Stairs, ramps, and landings came in second. Other building-related hazards were floors (14th on the list) architectural glass (16th), bathtubs and showers (19th), and non-glass doors (31st). OSHA has placed construction excavation and shoring at the top of its research priority list, followed by evacuation of a building during a fire.

Both OSHA and CPSC have responsibility in their own areas for promulgating national standards to help reduce the magnitude of the accident problem. In many cases OSHA and CPSC adopt already-existing voluntary standards or draw heavily from these standards in order to issue mandatory national standards without undue delay.

NBS' Center for Building Technology (CBT) has responded to the needs of these agencies for technical expertise in the building safety area by expanding its research and by appointing Brian C. Pierman as manager of safety research for other agencies. Pierman works in CBT's Office of Housing and Building Technology.

A few examples of NBS/CBT research activities show how varied the Bureau programs in this area have been.

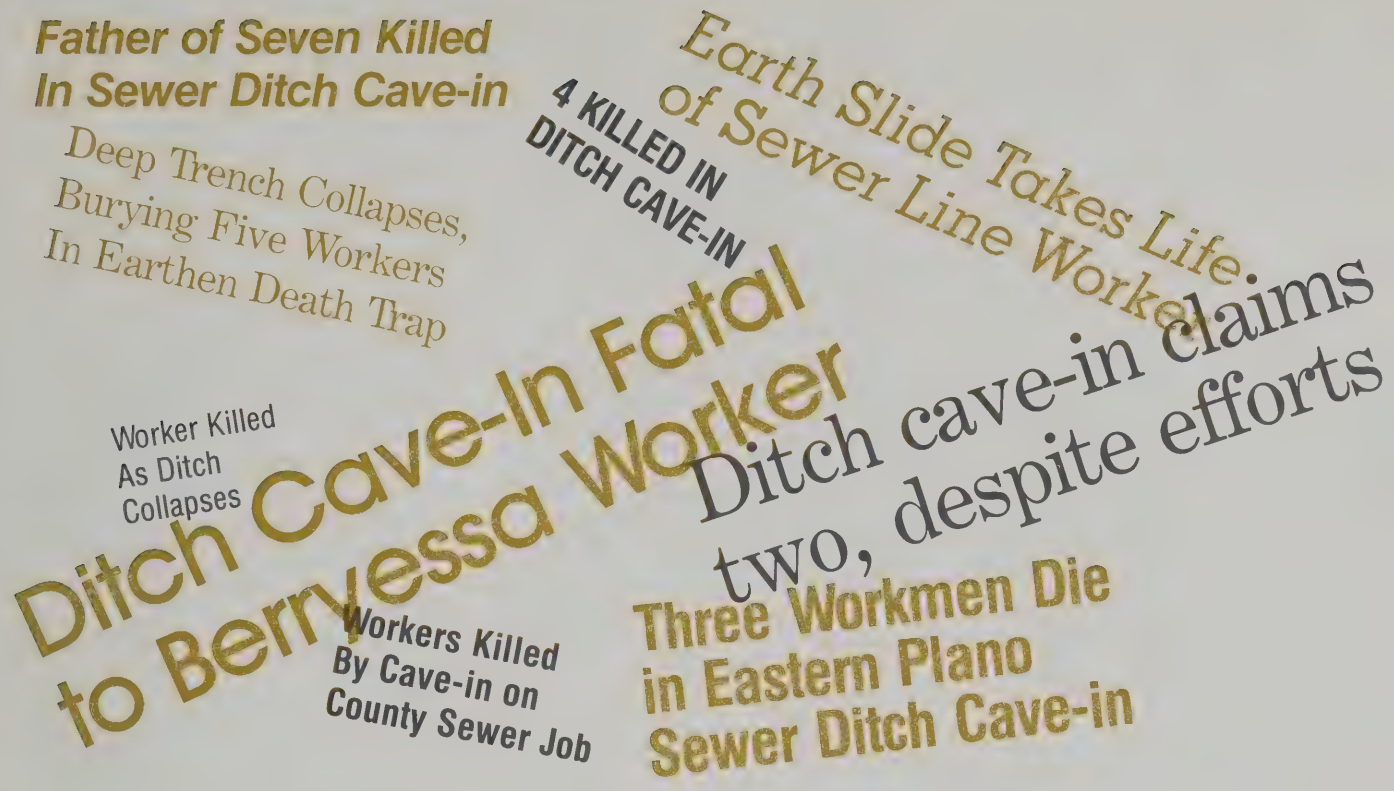
- Researchers gather information by using videotape to record how accidents occur on stairways. Although stair accidents are common, there is little factual information on how and why they occur. Studies of the videotape show the riser-tread relationship has only marginal effect on safety; more important are the irregularities from tread to tread.
- NBS also uses videotape to study door accidents. Researchers devised a number of recommendations for the CPSC on how glass doors could be altered to prevent people from walking into the glass. Such ideas as stick-ons and curtain covers were forwarded to CPSC for use in consumer education programs.
- NBS has conducted studies of slip-resistance of walking surfaces for more than 30 years. One result has been the development of a slip tester that has been used by CPSC to define a maximum level of slipperiness allowable in order to reduce the frequency of bathroom falls.
- Following the collapse of a major building under construction in suburban Washington, D.C., NBS undertook several research projects to improve the technology relating to safety problems identified in the disaster. This research will result in improved safety in concrete building construction relative to construction practices and concrete testing methods.
- For the Department of Housing and Urban Development, NBS is investigating emergency means of exiting from a mobile home, such as through windows and special escape hatches. The NBS work will provide the technical basis for the evaluation of existing evacuation standards and requirements for exit devices.

Increasingly, NBS has been called upon by the Occupational Safety and Health Administration to assist in developing technical bases for safety standards in the workplace. Two examples of these are emergency exiting requirements for building fires and performance criteria for trench and excavation shoring.

The current Life Safety Code, which sets standards for emergency exiting from buildings, is traceable to the National Fire Protection Association's Committee on Safety to Life. This committee was organized in 1913, published its first recommendations in 1916, and the first comprehensive exit code in 1927. NBS performed research to update this code in 1935 and, in 1966, it became known as the Life Safety Code. Many of the technical assumptions made more than 40 years ago, and upon which the present code is based, have been called into question. OSHA, which borrowed from portions of the Code to publish its own life-safety requirements for employers, has asked NBS to update the technical basis for building egress requirements.

NBS' first task has been to undertake an extensive literature survey to determine the technical basis for the present code. As this is completed, NBS will summarize and critique the data. This will permit NBS to make judgments on the adequacy of specific technical provisions and to offer recommendations on the need for new testing in order to update existing provisions.

At the same time, NBS' Center for Fire Research is undertaking a study of open stairwells which pose particular hazards because they can act like flues to draw smoke and flames into the stairs and to other levels of a structure inhibiting escape and endangering occupants. OSHA has given priority to this study because of the number of older buildings under the agency's jurisdiction which have open stairwells. NBS will investigate the use of sprinkler and deluge systems and construction techniques to minimize smoke and heat buildup in these open stairwells.



To do this work, NBS researchers are converting a missile silo in a former NIKE missile site adjacent to NBS headquarters in Gaithersburg, Md., into a three-story open stairway. A burn-room will be constructed adjacent to the stairwell and experiments will be conducted with various extinguishment and construction techniques to minimize smoke and heat movement. This work will be correlated with data on the time it takes occupants to exit a building.

Data from the stairwell experiments, as well as from the literature survey, will be reported to OSHA for its use in developing safety guidelines for workplaces. The NBS work is expected to influence the next revision of the Life Safety Code in 1979.

OSHA is also vitally interested in the problem of cave-ins at work sites which are caused by improper excavation and faulty shoring of trenches. In 1973, a total of 226 persons lost their lives as a result of slope failures in shallow excavations. Understandably, excavation and shoring are receiving priority attention in OSHA's work-related accident prevention program.

NBS will assist OSHA in developing standards for shoring. The work is being carried out in five steps over a two year period under the direction of Dr. Felix Y. Yokel of NBS' Center for Building Technology. First, NBS conducted a limited field investigation to discuss practices and problems with contractors, workmen, and OSHA inspectors.

The Bureau will then make recommendations for a soil classification system and for field techniques for identification of soils. A trench dug in sandy soil, for example, would be shored differently from one dug in clay.

NBS will also provide OSHA with criteria for hardwood and used timber employed as braces for trenches. Currently there are no guidelines for hardwood or for the re-use of timber. Under present conditions, inferior grade wood and timber with chips and splits or other defects—which weaken its capacity to support a load—can be used for shoring.

The next step will be to prepare the technical base for recommended standards. Currently OSHA uses a shoring and excavation standard which is severely criticized by the industry.

After performing engineering analyses on field data, NBS will recommend to OSHA new provisions for bracing and for sloped excavations. These will be incorporated into guidelines which can be used by OSHA inspectors, foremen, contractors, and engineers.

Finally, NBS will conduct a one-day workshop in order to receive public comment on its final recommendations to OSHA.

It is believed that standards which better reflect actual working conditions and which provide reasonably uniform safety margins will protect workmen and will also be acceptable to contractors.

A key element in improving the situation is a better understanding of the problems encountered by the workman and his foreman. To this end, NBS is working with the AFL-CIO's Building and Construction Trades Department in order to improve the flow of information.

NBS' program of building safety research is expanding to meet the needs of federal regulatory agencies for sound technical support for standards. The level of safety both for the persons who construct buildings and for those who work and live in them will rise appreciably as a result of this NBS research. □

ON LINE WITH INDUSTRY

MEASUREMENT ASSURANCE PROGRAM: CONTROLLING THE PROCESS OF CONTROL

by Michael Baum

Suppose your plant's quality control section was sued for "malpractice" on the grounds that their measurements were incorrect. Could you defend the measurement system in court?

Alternatively, suppose you have a growing pile of expensive scrap parts junked because they did not measure to spec. Can you be sure that good parts aren't being sacrificed to inaccurate measurements?

Those are two of the favorite images of Joseph Cameron, who until his recent retirement served as chief of the NBS Office of Measurement Services and patron of the Measurement Assurance Programs at NBS.

The Measurement Assurance Programs (MAPS) are comparatively new programs at NBS, dating from about 1965. They were developed primarily for industrial users whose work involves the calibration of other standards, and who therefore must maintain the best possible control over their own measurement process. Examples include facilities engaged in rating mass standards, volt standards, watthour meters, measures of capacitance, resistance and voltage ratio, as well as laser power meters.

Measurement assurance is the knowledge that the measurements made in your plant are "under control," that the uncertainty of any given measurement will be within known limits and that those limits are acceptable for the job at hand. A good measurement assurance program considers measurement as a process that results in a product, like any other manufacturing job, according to Cameron. Error in the process depends not only on the instruments or standards used, but on the environment of the measurement lab, the mounting or treatment of the instrument, and the operator or operators who make the measurements.

In traditional calibration programs, a customer would send the plant standards and instruments to NBS for calibration. The rest of the measurement process remained an unknown, and one could not always be sure the instruments survived the trip unchanged.

The NBS Measurement Assurance Programs are designed to furnished a rigid statistical method to analyze the customer's entire measurement system, just as it works in its day to day operation. The emphasis is shifted from assuring that the *instrument* is "accurate" to assuring that individual *measurements* are "accurate enough" for their intended use. A principal product of a MAP is a figure for uncertainty, which represents the difference between the plant measurements and the national standards, obtained by means of an NBS transfer standard. This enables the plant to control systematic error—fixed errors that are "built into" the measurement process but not measurable within the process.

A frequently used MAP technique is to measure carefully the value of a transport standard at NBS and ship it to the plant or laboratory being evaluated. There the standard is repeatedly measured over a period of time using the same process and personnel that are normally used in the plant's measurement program. The values they produce are sent back to NBS along with the transfer standard, which is measured again to make sure that it hasn't changed during transport and use. The NBS values are compared with the plant values to obtain the statistical offset of the process.

How does a lab set up a quality measurement program, one that can be "defended" if the need arises? Cameron suggests the following steps:

Find an appropriate reference base. Usually a reference base or measurement standard that is acceptable to the scientific and sometimes legal needs of the industry already exists. Often this base is provided by the National Bureau of Standards.

Determine your acceptable measurement error. How far off can your measurements be relative to the reference base and still be good enough for their intended use? Since increasing accuracy often means increasing cost, this is an important factor.

Know the properties of the measurement process. Where can errors arise? How much depends on the instrument used? The operator? The position of the instrument? The weather?

Repeat measurements. Redundancy is an important part of the measurement process. On a regular basis, repeat measurements on the same object to determine whether the process is out of control. Measuring "check standards" in parallel with unknown objects may accomplish the same objective. One needs a program by which he can show that his measurement process is in a state of control just as he has a quality control program for regular production items.

Calibrate the system as a whole using an NBS Measurement Assurance Program or the equivalent. Adjust the system for the offset from the national standards.

Test the local process at regular intervals to verify that the assumptions with regard to the physical model, corrections for ambient conditions, are valid.

Redetermine the process uncertainty periodically—the length of the period, of course, depends on the type of measurement, the accuracy needs of your plant, and the established historical stability of the process.

Cameron has recently retired as chief of the Office of Measurement Services, and has been replaced by Brian Belanger. For further information on Measurement Assurance Programs at NBS, write Brian Belanger, A345 Physics Building, National Bureau of Standards, Washington, D.C. 20234, or call 301/921-2805.

Baum is a writer and public information specialist in the NBS Office of Information Activities.

MEASURES FOR EQUITY: NCWM

by Harold Wollin

When the 62nd National Conference on Weights and Measures convenes in Dallas, Texas, on July 17, representatives from all levels of government, business and industry, and consumer groups will assemble to discuss matters that affect every citizen. Among their priorities will be the metric changeover as reflected in the marketplace, the possible adoption of international standards, and insulation as a factor in energy conservation.

These issues will be discussed in relationship to the goal of the forum: equity in the marketplace—the goal established along with the conference in 1905 by the first director of the National Bureau of Standards.

NCWM is the link between NBS, the federal agency responsible for uniform weights and measures, and state and local officials responsible for establishing and enforcing equitable practices in these areas; business and industry; and consumers. The major impact of NCWM comes through the model laws, regulations, technical codes, administrative guidelines, enforcement methodologies, and policies established by conference participants and then adopted by state and local governments and officials. The NBS Office of Weights and Measures supplies the technical support used by the conference in setting requirements for weighing and measuring devices and formulating the model laws and codes. The office also provides the executive secretariat to the conference and promotes the objectives of the Fair Packaging and Labeling Act by establishing uniform labeling regulations and the conduct of package quantity standards to encourage value comparisons among products.

One important area where NBS responsibilities and NCWM interests coincide is metrication. The Bureau will associate closely through the Office of Weights and Measures with both the U.S. Metric Conversion Board and the American National Metric Council to help achieve an orderly, efficient transition to metric. The voluntary aspect of conversion makes it imperative that each industry be permitted to "go metric" when it is economically advantageous to do so. At the same time, NBS is responsible for seeing that standards and laws change to keep pace with the transition. NCWM is the ideal mechanism for accomplishing this task. Its participants can make a coordinated effort to change federal and state laws to permit metric packages and devices and to gain public support for the conversion.

At the same time, America's conversion to metric provides the opportunity for incorporating international standards into U.S. standards relating to weights and measures. The U.S. is committed to doing this through its participation in international standards organizations, but differences between U.S. and international metrology standards need to be resolved. Again, NCWM is the appropriate mechanism for accomplishing this goal.

Another issue to be discussed next month concerns energy conservation—an issue of considerable import to the consumer. Specifically, the conference will determine the proper method of sale and the necessary labeling requirements which will provide consumers with the information that enables a value comparison between different types of insulation. Information being considered as mandatory labeling for a method of sale includes the R value, which is a measure of resistance to heat transfer; the net coverage that can be obtained from the package; the minimum thickness that should be installed; and the net weight of the package. Each piece of information must be evaluated in terms of fairness between manufacturers, pertinence in reflecting the quality of the product, accuracy in indicating the quantity in the package, and usefulness to the consumer. This must be done without placing an excessive burden on the industry so the cost of the practice does not exceed the benefit to consumers.

The National Conference on Weights and Measures has an excellent record in achieving its goal of equity in the marketplace. Hopefully, next month's conference will add significantly to those achievements.

Wollin is chief of the NBS Office of Weights and Measures.

STAFF REPORTS

PROFILE ANALYSIS OF NEUTRON DIFFRACTION POWDER PATTERNS

The new technique of profile analysis, applied to neutron diffraction powder patterns, has made the powder technique competitive with single-crystal studies in the precise determination of the crystal structure of materials having 25-50 atoms in the unit cell. NBS is at the forefront in this country in the development and application of profile analysis for structural quantitative analysis.

Antonio Santoro, Reactor Radiation Division, A106 Reactor Building, 301/921-3634.

Many important crystalline materials cannot be obtained as single crystals suitable for x-ray or neutron diffraction analysis, and must be studied by powder dif-

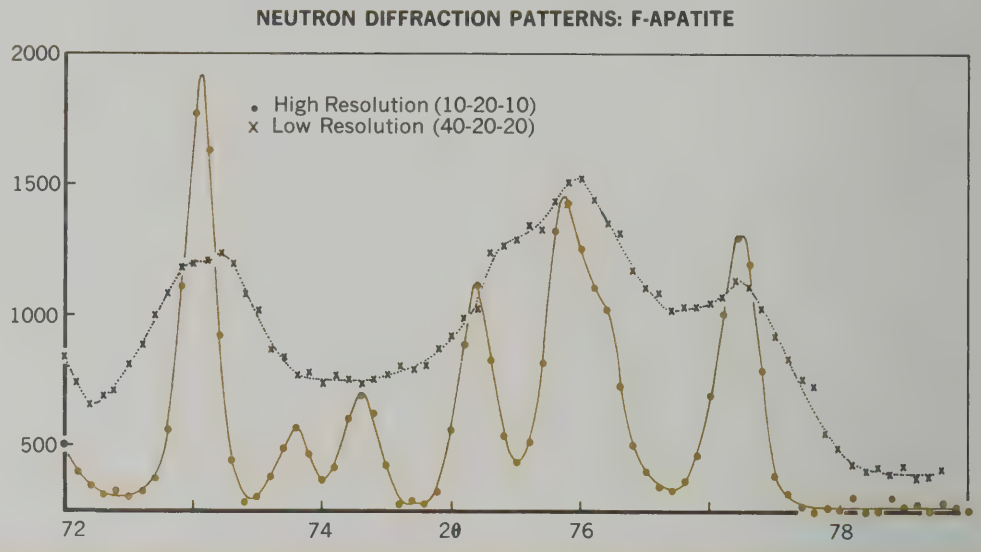
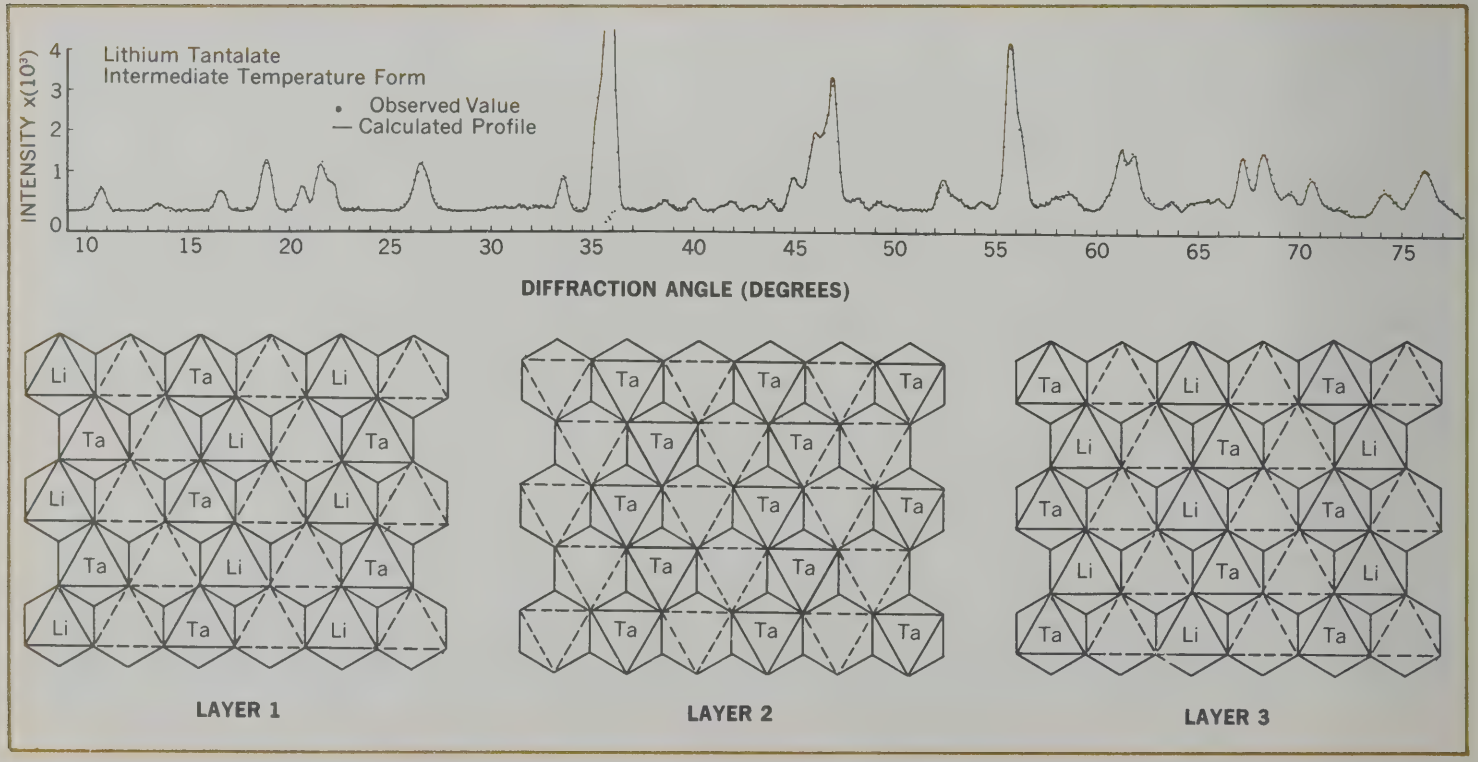


Figure 1—Observed Profiles of Part of the Powder Pattern of Fluoroapatite at Two Different Resolutions. *The two sets of three numbers enclosed in parentheses are the horizontal angular divergencies, expressed in minutes arc, of the in-pile collimeter, the collimeter of the monochromatic beam, and the collimeter of the diffracted beam, respectively. Note the loss of details in the pattern of low resolutions.*

Figure 2—Comparison Between Observed and Calculated Profiles for the Intermediate Temperature Form of $LiTa_3O_8$. *The structural model corresponding to the calculated profile is built by dispersing layers of octahedra as indicated.*



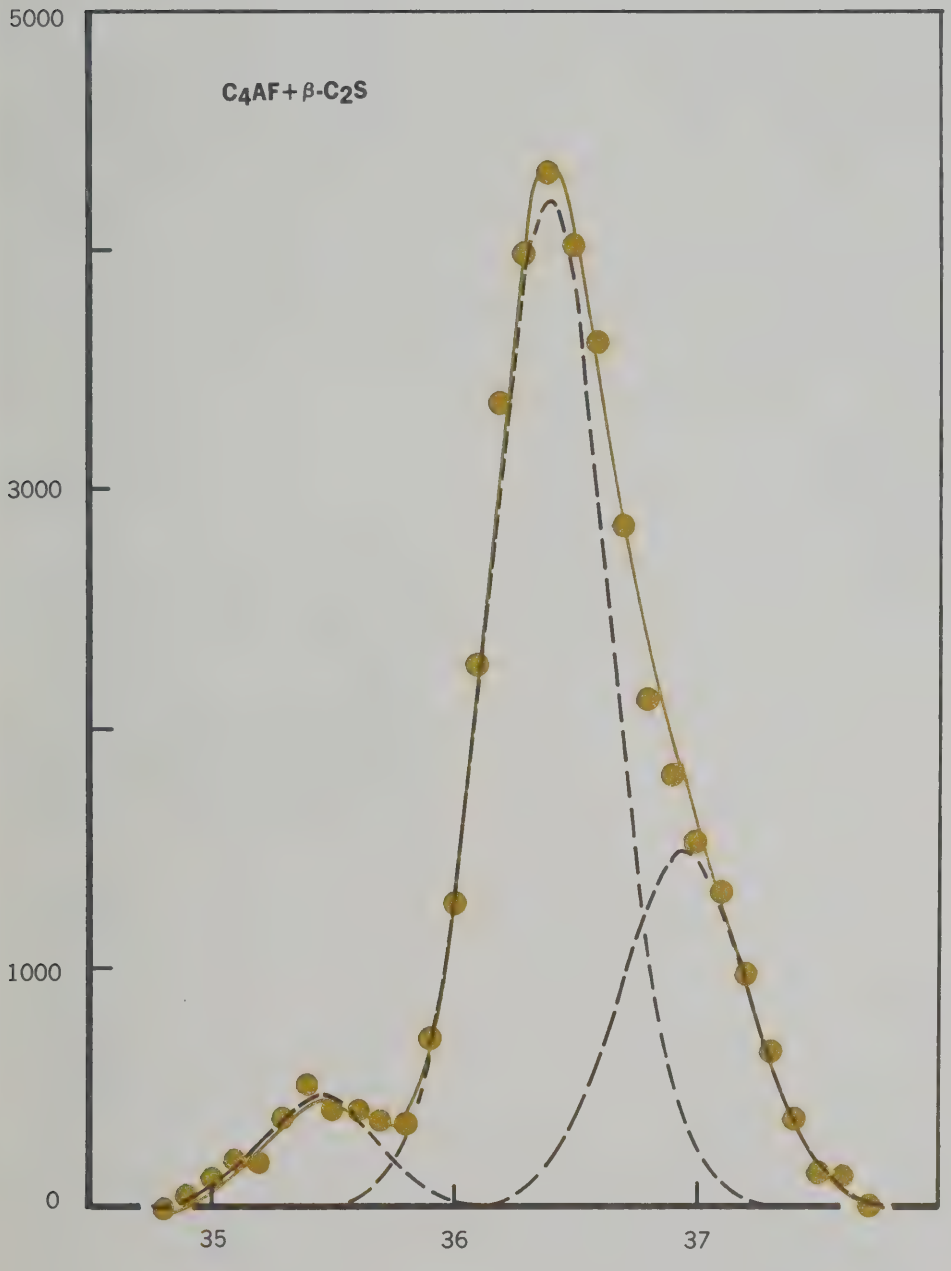


Figure 3—Separation of Overlapped Peaks in a Mixture of β-Ca_2SiO_4 and $4CaO \cdot AP_2O_3 \cdot Fe_2O_3$, Two Cement Components. *The dots represent the experimental points, the continuous line is the least-squares fit through these points obtained by refining the nine parameters defining three Gaussians, and the broken lines represent the three separated peaks.*

fraction techniques. But there is a fundamental difficulty associated with powder diffraction: the random orientation of crystallites in the powder produces overlapping peaks in the diffraction pattern, making it impossible in many cases to measure the integrated intensities of single reflections.

To overcome this problem, H. M. Rietveld developed the technique of profile analysis. The essence of this method is fitting, by least-squares procedures, the entire diffracted profile with one calculated from a possible structural model of the material. Such fitting utilizes not only the intensities of single peaks and peak clusters, but all other details contained in the measured profile.

While profile analysis offers great promise in both x-ray and neutron diffraction work, at present it is best suited to neutron diffraction because:

- the neutron peak shape is nearly Gaussian;
- the variation of full width at half maximum with diffraction angle can be described with a simple quadradic function. As yet, no generally satisfactory expression has been found for describing x-ray peak profiles.

Profile analysis is now being used by a number of laboratories in the United States and has been applied to the ongoing neutron diffraction program at the NBS reactor facility. Work at NBS includes structural analysis of:

- Ionic conductors having potential use in the development of fuel cells and fast ion batteries. This work provides essential information on the structural chemistry of the light ions that determine the important conductive properties of these materials.
- Dental apatites, with emphasis on the characterization of nondefective materials used as standards in the study of defective structures and the chemistry of teeth.
- Metal hydrides which are good candidates for hydrogen storage. Determining the structure of hydrides, and par-

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ticularly the location of hydrogen in the unit cell, may indicate possible mechanisms for hydrogen retention and release and may suggest ways to prepare and use more efficient systems.

- Crystalline cement components, as well determined structures and lattice parameters for these materials are the starting point for the study of phases with variable composition, and for quantitative structural analysis.
- The chemistry of lead-acid batteries, including determination of the crystallinity of plate materials and of crystallite sizes and shapes which are related to the chemistry and performance of storage batteries.

At NBS, operation of the neutron spectrometer, collection of data, and the related profile analysis are done by computer. Depending on a number of factors, an experiment may take from 1 to 7 days.

Of prime importance to the success of profile analysis is the instrumental resolution of the powder diffractometer. High resolution permits a better estimate of the background and reduces the loss of information due to overlapping. With the diffractometer used at NBS, the full width at half maximum of diffracted peaks ranges from 12.1 to 15.6 minutes of arc in the angular interval $\Delta 2\theta$ between 0° and 85°. This performance is comparable to that of modern x-ray spectrometers.

Thus far, profile analysis has been applied only to powders of pure crystalline phases which by themselves do not affect the shapes of the diffracted peaks.

Experimental and theoretical improvements of profile analysis/neutron diffraction are underway at NBS. For example, measurement of crystallite sizes and lattice parameters, and the quantitative analysis of crystalline phases present in a mixture, are logical extensions of the work. So is the study of materials at high pressure and at high or low temperatures since the sample containers necessary for these experiments do not attenuate neutron beams as they do x-rays.

FIRE MODELING GROUP ORGANIZED

The NBS Center for Fire Research (CFR) has organized an Ad Hoc Group on mathematical fire modeling to coordinate on a national basis the modeling activities of the Center, CFR grantees, private research organizations, universities, and other government agencies.

Robert S. Levine, Fire Science Division, B62 Technology Building, 301/921-3845.

The Committee's objective is to make fire modeling a cooperative venture rather than a competitive one. It is expected that through cooperation, a comprehensive model of fire behavior in enclosures can be developed within seven years. This model will predict how building fires will behave when variables such as ignition source, room geometry, ventilation, construction materials, and furnishings are changed. An effective model will give architects, designers, and building code officials the information needed to build safer buildings and will reduce the fire research community's current dependence on expensive full-scale tests.

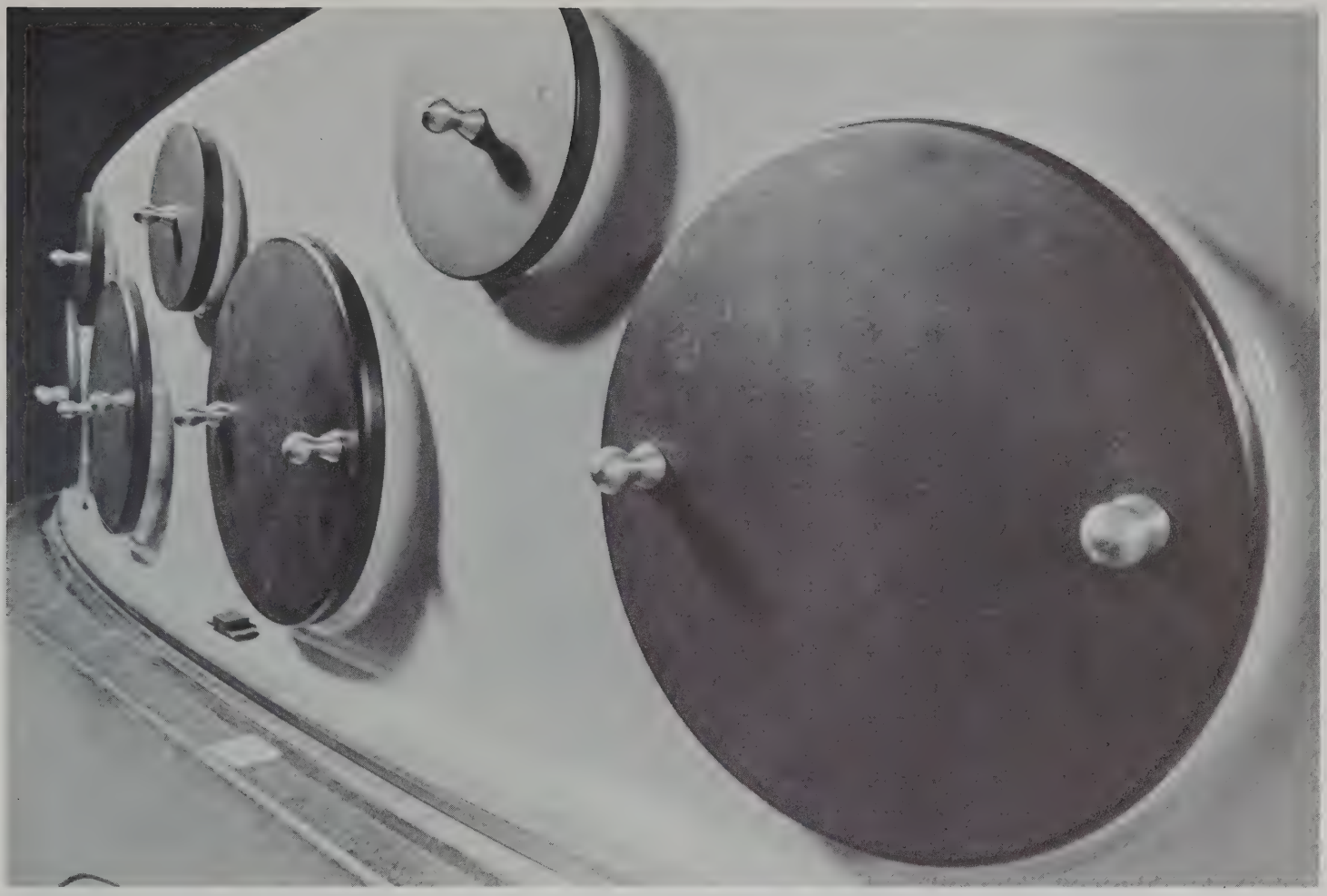
Four major committees have been established. The Committee on Synthesis, Models, and Scenarios is responsible for developing a computer model of fire behavior which is of maximum benefit to the user community. The Committee on Definitions and Coding is selecting standard computer nomenclature and formats so that various subprograms can be "plugged into" the model and so that all investigators will be able to use data for full-scale tests conducted by any of the organization. The Subprogram Committee will develop uniform ways to express fire phenomena in mathematical terms. A Steering Committee, composed of representatives from participating agencies, will encourage sponsorship of key aspects of the overall program. (Dr. Robert S. Levine, Chief of the Fire Science Division of the Center for Fire Research, heads the Steering Committee.—ed.)

HYDROCARBON-IN-AIR STANDARD REFERENCE MATERIALS

The NBS Office of Standard Reference Materials announces the availability of three hydrocarbon-in-air Standard Reference Materials (SRM's). These SRM's are intended for use in the calibration of instruments and techniques for the analysis of the hydrocarbon content of ambient air, and are available in the following concentrations by volume: SRM 1658 Methane (0.951 ppm) in Air, SRM 1659 Methane (9.43 ppm) in Air, SRM 1660 Methane (4.10 ppm) and Propane (0.976 ppm) in Air.

The hydrocarbon content of air consists essentially of two fractions, naturally occurring methane and a complex mixture of other hydrocarbons largely resulting from man's activity. A standard containing only methane as the hydrocarbon constituent may be used to calibrate instruments which measure total hydrocarbon in the atmosphere. However, calibration of instruments that differentiate between methane and the sum of all other hydrocarbons requires a standard containing methane and a hydrocarbon which can easily characterize as to concentration, is of known stability, and can be easily distinguished from methane by analytical techniques normally used for such analysis. Propane satisfies these requirements and was therefore used as the non-methane fraction of SRM 1660. The concentration of either methane or propane in all three of these SRM's is certified with a total uncertainty of 1 percent relative and is considered to be stable for at least one year.

Standard Reference Materials 1658-1660 are supplied in steel cylinders containing 0.85 m^3 (30 cu. ft.) at standard temperature and pressure. The cost is $283 per cylinder. Purchase orders for these SRM's should be sent to the Office of Standard Reference Materials, Room B311, Chemistry, National Bureau of Standards, Washington, D.C. 20234.



NBS grazing incidence spectrograph used to record spectra (5 to 60nm) of ions of refractory metals. The very high resolving power of this unique instrument makes it possible to distinguish lines of different ionization stages by observing their individual widths.

SPECTRA OF HIGHLY IONIZED MOLYBDENUM AND HEAVY ELEMENTS PROVIDED FOR FUSION DIAGNOSTICS

NBS physicists have measured the main spectral lines of the ions Mo $^{+12}$ and Mo $^{+13}$ in the far-vacuum ultraviolet range, 10 to 50 nm. Related NBS measurements have given needed wavelength identifications for several different ions of Ta, W, Re, Pt, Au, and Hg up through Hg $^{+12}$, which are also of interest. These data are being used by fusion scientists to diagnose important impurities that limit the performance of controlled thermonuclear reactors such as Tokomak devices. A recent ERDA review of work in this field . . described the results as "very important" for CTR [controlled thermonuclear reaction] diagnostics.

Joseph Reader and Jack Sugar, Optical Physics Division, A163 Physics Building, 301/921-2011.

All existing Tokomak plasma devices are limited by the presence of impurity atoms and ions in concentrations of up to several per cent. It has been shown that up to 40 per cent of the power loss in these devices occurs through spectral-line radiation from the impurities, which are thought to be up to 40 times ionized. These impurities arise through particle bombardment of the vacuum walls and the "limiter", an annular molybdenum or tungsten ring which is placed at one point in the periphery of the plasma to prevent circulating particles from striking the walls of the doughnut-shaped container. With sufficiently high temperatures impurities may be up to 70 times ionized. Thus, in the presence of heavy ions such as molybdenum or tungsten, the power loss may be so great that the temperature necessary for fusion may not be obtainable.

Previous to this NBS work, practically no spectral data were available for such ions, in large measure owing to the complexity of the high-ionization spectra. The NBS work takes advantage of recent developments in triggered spark sources with high current density, which raise the probability of high-multiple-ionization events. (See figures.)

This work gives the first independent confirmation of identity for some of these lines, which are already being used as time- and temperature-diagnostic indicators in some Tokamak plasma machines.

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References

1. Kaufman, V., and Sugar, J., "Wavelengths, Classifications, and Ionization Energies in the Isoelectronic Sequences from Yb_{II} and Yb_{III} through Bi_{XV}, and Bi_{XVI}," J. Opt. Soc. Am., Vol. 66, No. 10 (Oct. 1976).

2. Reader, J., and Acquista, N., "4s4p Resonance Transitions in Highly Charged Cu- and Zn- like ions," in preparation.

Figure 1—Spectrum Lines of Mo Produced at Various Voltages in Spark. *The lines due to Mo^{+12} and Mo^{+13} ions (Mo XIII and Mo XIV) are used for diagnosis of plasmas in controlled fusion reactors. The wavelengths are in Å units (1Å = 0.1 nm).*

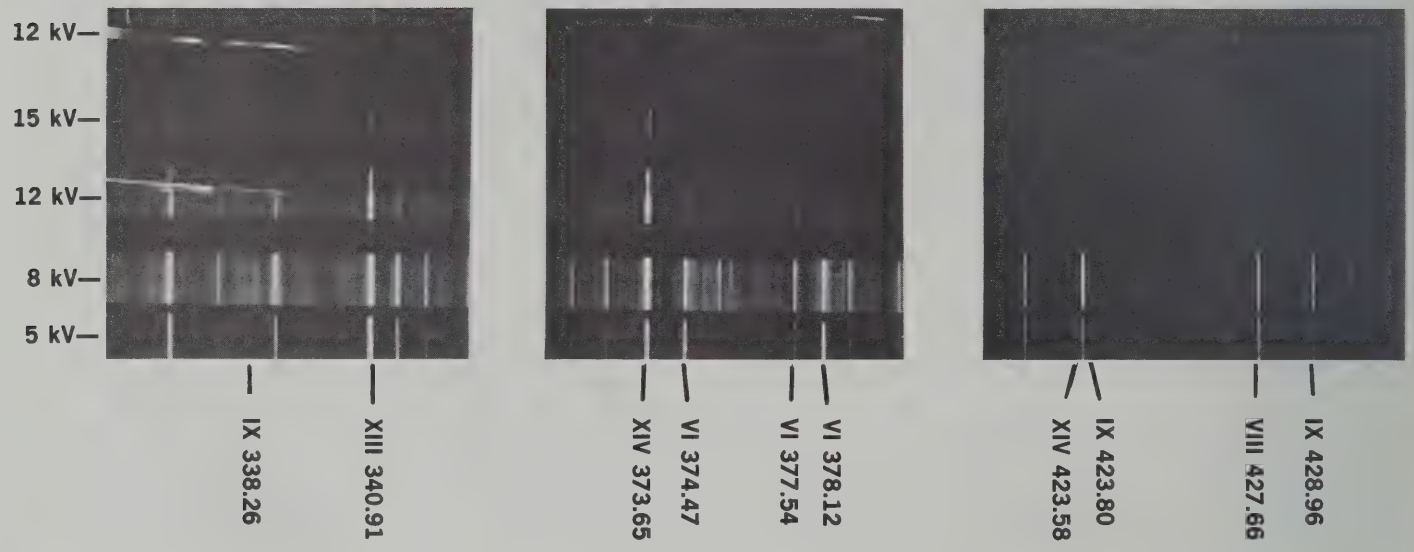
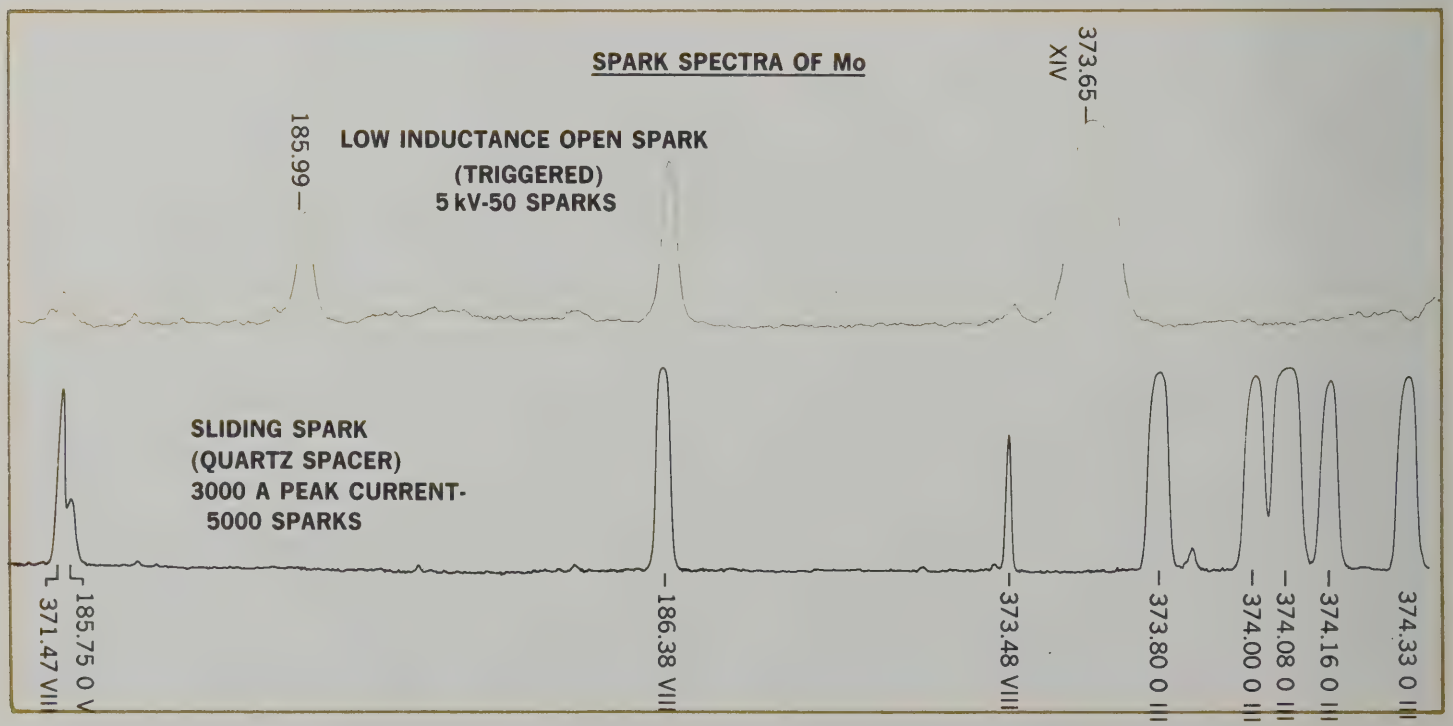


Figure 2—Tracings of Mo Spectra from a High Voltage Open Spark (above) and Low Voltage Sliding Spark (below). *The sliding spark helps to distinguish the stages of ionization because it does not produce atoms ionized more than eight times. The O III lines in the lower tracing are due to oxygen released from a quartz spacer in the sliding spark. The width of the line due to Mo XIV in the upper tracing is much greater than the widths of lines due to lower ionization stages.*



MECHANISM FOR TRANSFERRING FEDERAL TECHNOLOGY TO STATE AND LOCAL GOVERNMENTS

The following report describes how an "information bridge" has been established to transfer techniques and technologies from NBS to state and local officals and the private sector.

The National Bureau of Standards has forged new links with state and local governments in two areas of prime importance—energy conservation and procurement.

Beginning in May, Joseph G. Berke, formerly chief of procurement policy for NBS' Experimental Technology Incentives Program, entered a one-year association with the National Governors' Conference (NGC), headquartered in Washington, D.C. Berke is working under the Intergovernmental Personnel Act and is assigned to NGC energy programs headed by Edward L. Helminiski.

Through his assignment with NGC, Berke will assist state and local governments in introducing energy-conservation measures into their procurement programs. He will also provide feedback to NBS in those areas of energy concern where NBS can assist the State and local jurisdictions.

The initiative for Berke's timely assignment came from the Energy Policy and Conservation Act, signed into law in December 1975. This act requires the states to establish mandatory standards and policies that introduce energy efficiency into purchasing practices at the state and local levels. NGC has been working with the Federal Energy Administration and the Energy Research and Development Administration to implement this part of the act by developing mechanisms for energy-efficient procurement and by providing technical assistance to the states once they have the mechanisms.

Berke is no stranger to government procurement policies. While in NBS' Experimental Technology Incentives Program he helped design experiments to incorporate energy conservation measures into federal procurement programs and worked with state and local associations of purchasing officials to encourage innovations in their procurement procedures.

One innovative effort was in the area of life-cycle costing. This is a procedure by which purchasing officials look at the total costs of purchasing and maintaining products rather than just the initial outlay. Thus, the low bidder may not have the least-expensive product when the costs of operation and maintenance (including energy costs) are figured in over the product's life time. The product with a higher initial cost—but greater energy efficiency—may be the best buy under the life cycle-cost concept. As a result of ETIP initiative, life-cycle costing now is an integral part of the federal government's procurement policies.

Berke will apply his procurement experience in the development of purchasing criteria as outlined in the Energy Policy and Conservation Act. He will be working directly with state energy advisors, state and local purchasing officials, industry representatives, and product users.

At the same time, he will be listening to these officials and identifying their technological needs. Wherever possible, he will match these needs with NBS output, such as test methods and procedures and technical information. He will also inform NBS managers of needs which NBS cannot meet immediately but which might form the basis for future research efforts at NBS. This complies with a memorandum issued by President Carter last February 25 which encouraged federal executives to consider state and local concerns when planning new programs.

Dr. Jack E. Snell, head of the Office of Energy Conservation in NBS' Institute for Applied Technology, sees Berke's assignment as another means of opening channels of communication between NBS and users of its products—in this case state and local governments.

As one potential example, Snell sees a role for NBS in providing technical assistance and information on standards and measurement technology to states to assist them in meeting the President's goal of 90 percent of the nation's homes being insulated by 1985.

Berke will also be working closely with Eric Vadelund of NBS' Center for Consumer Product Technology. Vadelund is manager of a pilot project designed to take a specific product and develop a specifications package that state and local purchasing officials could use in making their procurement selections.

The first step will be to conduct a brief survey of nine government units—three each at the city, county, and state levels —to determine whether there is a need for such a specifications package and, if so, in what areas.

Collectively, Vadelund notes, state and local governments have tremendous potential purchasing power. This is power that could be used as leverage to improve the efficiency and technical performance of products. The potential savings in terms of dollars and energy use are considerable.

Developing specifications packages for government purchasing officials would promote uniformity in purchase decisions by allowing the officials to make their decision based on the best-available data on product cost, performance, and efficiency.

Another NBS contact for Berke in his new assignment will be James W. Wyckoff, who heads the State and Local Governments Program in the Office of the Associate Director for Programs. Wyckoff has been strengthening the contacts between the Bureau and state and local levels of government. His most recent effort (see *Comment* on inside front cover) is a research associate program designed to bring state and local technical experts to NBS for a year or more of work in areas of mutual technical interest.

The efforts of Berke, Vadelund, Wyckoff and others should make NBS a more useful and accessible technical resource for state and local governments. This is especially important in that state and local governments constitute the delivery mechanisms for most of the actual services provided by the federal government.

CONFERENCES

For general information on NBS conferences, contact Sara Torrence, NBS Office of Information Activities, Washington, D.C. 20234, 301/921-2721

RESEARCH AND INNOVATION IN THE BUILDING PROCESS CONFERENCE

The National Bureau of Standards has issued a call for technical papers to be presented at a building regulatory research conference and a workshop in administrative procedures for building regulatory officials, September 20, 1977, in conjunction with the Tenth Annual Meeting of the National Conference of States on Building Codes and Standards (NCSBCS) in Great Falls, Mont.

The joint NBS/NCSBCS conference and workshop will provide an opportunity for researchers from industry, universities, public interest groups, and government to interact with state and local building regulatory officials and code administrators. The program is similar in scope to one held last year in Providence, R.I.

The purpose of the joint sessions is to provide forums for the exchange of research findings and for reports of innovative practices among regulatory agencies.

The joint conference seeks papers in the following or related subject areas:

- Studies of the legal, economic and other bases of building regulation.
- Reports of the evaluation or assessment of the management and procedures of regulatory agencies.
- Studies of the effects of building regulation.
- Studies of planning, policy or political action aimed at regulatory building construction.
- Studies of the relation of building regulation to other forms of development control.
- The needs of building officials for regulatory research.
- Measuring the economic impact of research on building standards and codes.
- Innovative administrative applications —new management techniques or procedures for building officials.
- Experiences with computers and cicrofilm in building code enforcement functions—successes and failures.
- Consensus standards formulation.
- Procedures for better communications with architects, engineers, and contractors.
- Implementation of energy conservation building standards.
- Implementation of metric conversion on building regulation.

A one-page typed abstract of each paper, along with a biographical sketch, should be submitted before July 15, 1977, to Patrick W. Cooke, Office of Building Standards and Codes Services, Center for Building Technology, IAT, Room B226, Building 226, National Bureau of Standards, Washington, D.C. 20234.

Upon review of abstracts by the Codes Administration Committee of NCSBCS, selected authors will be notified. Final papers will be due by September 15, 1977.

For further information contact: Patrick Cooke, B226 Building Research Building, 301/921-3361.

DATA ELEMENTS MANAGEMENT SYMPOSIUM

Paths toward improved data management practices and standards for more effective handling of computerized information will be explored at the Third National Symposium on the Management of Data Elements in Information Processing, to be held at the National Bureau of Standards, Gaithersburg, Maryland, September 28-30, 1977.

Sponsored by the NBS Institute for Computer Sciences and Technology (ICST) and the American National Standards Institute (ANSI) Committee X3L8, the symposium will focus on leading topics including:

- Management of data resources and data requirements
- Data element dictionary/directories
- Standards for data in commerce and trade
- Standards needs in the areas of
  health care information systems
  energy information systems
  museum data interchange systems

Highlights of the final report of the Commisison on Federal Paperwork will be presented at the symposium by the Commission's director, Warren Buhler.

Criteria for evaluation and selection of data dictionary/directory systems will be discussed by Bernard K. Plagman, vice president of DBD Systems, Inc.

Symposium workshops on September 30 will consider future directions and needs for data standards.

The registration fee for the three-day symposium is $55, received in advance. All symposium registrants will later receive a copy of the proceedings.

For additional registration information, please contact: Hazel McEwen, Institute for Computer Sciences and Technology, B226 Technology, Building, 301/921-3157.

CONFERENCE CALENDAR

June 13-15
CONFERENCE ON ULTRASONIC TISSUE CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS, National Institutes of Health, and National Science Foundation; contact: Melvin Linzer, A329 Materials Building, 301/921-2858.

***July 4-8**
THIRD INTERNATIONAL CONFERENCE ON LASER SPECTROSCOPY, Jackson Hole, Wyoming; sponsored by NBS; contact: John Hall, NBS, Boulder, Colo., 303/499-1000, ext. 3126.

***July 11-12**
ELECTROMAGNETIC INTERFERENCE WORKSHOP, NBS, Gaithersburg, MD; sponsored by NBS; contact: Walter Alspach, NBS, Boulder, Colo., 303/499-1000, x3285.

***August 2-5**
CRYOGENIC ENGINEERING CONFERENCE, University of Colorado, Boulder, Colo.; sponsored by NBS, the Cryogenics Engineering Conference Board and the University of Colorado; contact: Dee Belsher, NBS, Boulder, Colo., 303/499-1000, ext. 3981.

***August 22-26**
TIME AND FREQUENCY: STANDARDS, MEASUREMENTS, USAGE, NBS, Boulder, Colo.; sponsored by NBS; contact: Helmut Hellwig, NBS, Boulder, Colo., 303/299-1000, ext. 3277.

September 7-8
SEMINAR ON EARTHQUAKE DESIGN CRITERIA, STRUCTURAL PERFORMANCE, AND STRONG MOTION RECORDS, NBS, Gaithersburg, MD; sponsored by NBS, EERI; contact: Dr. Richard Wright, B244 Building Research Building, 301/921-3377.

September 21-23
SYMPOSIUM ON ROOFING TECHNOLOGY, NBS, Gaithersburg, MD; sponsored by NBS and the National Roofing Contractors Association; contact: Robert G. Mathey, B348, Building Research, 301/921-3407.

* New Listing

September 28-30
DATA ELEMENT MANAGEMENT SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and ANSI Committee X3L8; contact: Hazel McEwen, B226 Technology Building, 301/921-3157.

October 3-6
ALTERNATIVES FOR CADMIUM ELECTROPLATING IN METAL FINISHING, NBS, Gaithersburg, MD; sponsored by NBS, Consumer Product Safety Commission, Department of Defense, Department of Interior, Occupational Safety and Health Administration, Environmental Protection Agency, Food and Drug Administration, and General Services Administration; contact: Fielding, Ogburn, B166 Polymers Building, 301/921-2957.

October 11-13
MATERIALS FOR COAL CONVERSION AND UTILIZATION, NBS, Gaithersburg, MD; sponsored by NBS, Energy Research and Development Administration, Electric Power Research Institute; contact: S. J. Schneider, B303, Materials Building, 301/921-2893.

October 11-14
COMPUTER PERFORMANCE EVALUATION USERS GROUP, 13th MEETING, New Orleans, LA., sponsored by NBS; contact: Dennis Conti, A248 Technology Building, 301/921-3861.

***October 17-19**
TIME AND FREQUENCY CALIBRATION: METHODS AND RESOURCES, NBS, Boulder, Colo.; sponsored by NBS; contact: Roger Beehler, NBS, Boulder, Colo., 303/499-1000, ext. 3281.

***October 19-20**
RELIABILITY TECHNOLOGY FOR CARDIAC PACEMAKERS, NBS, Gaithersburg, MD; sponsored by NBS; contact: Harry A. Schafft, A327 Technology Building, 301/921-3625.

November 1-3
MECHANICAL FAILURES PREVENTION GROUP, NBS, Gaithersburg, MD; sponsored by NBS and MFPG; contact: Harry C. Burnett, B260 Materials Building, 301/921-2818.

November 13-17
WORKSHOP ON RAPID SOLIDIFICATION TECHNOLOGY, Sheraton-Reston, Reston, VA; sponsored by NBS, ARPA; contact: Dr. Arthur Ruff, B264 Materials Building, 301/921-2811.

December 5-7
WINTER SIMULATION CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS, the Association for Computing Machinery, the Institute of Electrical and Electronic Engineers, Operations Research Association of America, the Institute for Industrial Engineers, and the Society for Computer Simulation; contact: Paul F. Roth, B250 Technology Building. 301/921-3545.

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***April 10-13**
TRACE ORGANIC ANALYSIS: A NEW FRONTIER IN ANALYTICAL CHEMISTRY, NBS, Gaithersburg, MD; sponsored by NBS; contact: Harry S. Hertz, A105 Chemistry Building, 301/921-2153.

***April 17-20**
ACOUSTIC EMISSION WORKING GROUP MEETING, NBS, Gaithersburg, MD; sponsored by NBS; contact: John A. Simmons, B118 Materials Building, NBS, 301/921-3355.

***April 17-20**
AMERICAN NUCLEAR SOCIETY TOPICAL CONFERENCE ON COMPUTERS IN ACTIVATION ANALYSIS AND GAMMA RAY SPECTROSCOPY: Mayaguez, Puerto Rico; sponsored by NBS, American Chemical Society, American Nuclear Society, Energy Research and Development Administration, U. of Puerto Rico, Puerto Rico Nuclear Center; contact: B. S. Carpenter, B108 Reactor Building, NBS, 301/921-2167.

***May 8-10**
SYMPOSIUM ON REAL-TIME RADIOGRAPHIC IMAGING, NBS, Gaithersburg, MD; sponsored by NBS and the American Society for Testing and Materials; contact: Donald A. Garrett, A106 Reactor Building, 301/921-3634.

***June 26-29**
CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS, Ottawa, Ontario, Canada; sponsored by Institute of Electrical and Electronics Engineers, U.S. National Committee-International Union of Radio Science, and NBS; contact: Dee Belsher, NBS, Boulder, Colo., 303/499-1000, ext. 3981.

PUBLICATIONS

LANDMARK VOLUME ON ULTRASONIC TISSUE CHARACTERIZATION PUBLISHED

Ultrasonic Tissue Characterization, Linzer, *M*,. Nat. Bur. Stand. (U.S.), Spec. Publ. 453, 274 pages (Oct. 1976), SD Catalog No. C13.10:453, $3.55.

The first comprehensive compilation of definitive articles on the measurement of ultrasonic parameters of tissue for medical diagnosis has been published by the National Bureau of Standards.

The 274-page book, titled *Ultrasonic Tissue Characterization*, contains papers presented at the first international Seminar on this subject held at NBS in May 1975. The meeting, which was cosponsored by NBS, the National Science Foundation (NSF) and the National Institutes of Health (NIH), brought together more than 220 leading ultrasound experts from the United States, Canada, Europe, Japan, South America, and Australia.

The seminar served as a forum for the examination of the state-of-the-art and prospects for research in the newly emerging discipline of ultrasonic parameter measurement. A second international symposium on ultrasonic tissue characterization is scheduled to be held June 13-15, 1977, at NBS in Gaithersburg, MD.

According to conference chairman and proceedings editor Melvin Linzer, "The seminar undoubtedly marked a milestone in the use of medical ultrasound as a major non-invasive diagnostic technique. The proceedings of the seminar should play a landmark role in the future development of the field."

Linzer explains that ultrasound is increasingly being used in medical diagnostics to detect possible birth complications and to diagnose heart disease, breast cancer, eye disorders and a host of other ailments. In many cases, ultrasonic signals can provide more information about tissue condition than x-rays. For example, it may be possible to use ultrasound to identify the detailed nature of damaged heart muscle and malignant tumors, he says.

Despite impressive clinical advances in the use of ultrasound, Linzer says that researchers are just beginning to learn how to collect and interpret ultrasound tissue "signatures" or patterns, created by the passage and reflection of sound waves through the tissue. The signatures are made up of a number of parameters which can be measured both qualitatively and quantitatively.

Linzer, an NBS research chemist, is chairman of an international committee on tissue signatures whose purpose is to stimulate the exchange of tissue signature information among interested researchers, clinicians, and instrument designers worldwide. The committee is funded by NSF.

The seminar proceedings contain 21 articles related to the use of ultrasonic parameter measurement in the quantitative characterization of tissue. Topics included are tissue properties, A-scan pattern recognition techniques, attenuation and velocity techniques, absorption techniques, scattering techniques, impedance profile techniques and acoustic microscopy.

NBS is currently collaborating with NIH in the development of novel techniques for ultrasonic medical diagnosis. The NBS work in ultrasound is an outgrowth of its program in Nondestructive Evaluation (NDE) aimed at assisting industry and government in developing standards and techniques for NDE.

WHY WASTE HEAT?

Waste Heat Management Guidebook for Industry and Commerce (EPIC), Massey, R. G., Ed., Nat. Bur. Stand. (U.S.), Handb. 115, Suppl. 1, 89 pages (Dec. 1975), SD Catalog No. C13.11:115/1, $2.75.

A new guide designed to inform engineers and managers about current options in waste heat recovery has been issued by the National Bureau of Standards, in cooperation with the Federal Energy Adminstration (FEA).

The main purpose of the *Waste Heat Management Guidebook* is to help the engineer and manager decide whether they can increase profits by installing waste heat equipment and to help them choose the best available equipment for the purpose. NBS and FEA estimate that a typical plant that installs waste heat recovery equipment could save about 20 percent of its fuel per year.

The eight chapters of the book were developed by waste heat engineering experts in industry, universities and at NBS. The heart of the guide is 14 actual case studies of companies that have recently installed waste heat recovery systems and profited. They represent major commercial options in waste heat recovery equipment and various industrial applications such as glass making, forge furnace operation, paint and varnish processing, food processing, utility operations and agriculture.

The book contains 7 additional chapters. They include information on:

- Sources and uses of waste heat
- Determination of waste heat requirements
- Economics of waste heat recovery
- Commercial options in waste heat recovery equipment
- Instrumentation
- Engineering data for waste heat recovery
- Assistance for designing and installing waste heat systems

The *Waste Heat Management Guidebook* is part of the Department of Commerce program, based on the *Energy Conservation Program Guide for Industry and Commerce (EPIC)*, to assist industry and commerce in adjusting to the increased cost and shortage of energy. EPIC is available for $2.90. Use SD Catalog No. C13.11:115 when ordering.

Building Technology

Fattal and L. E. Cattaneo, *Evaluation of Structural Properties of Masonry in Existing Buildings,* Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 62, 127 pages (Mar. 1977) SD Catalog No. C13.29/2:62, $1.90.

Leyendecker, E. V., and Fattal, S. G., *Investigation of the Skyline Plaza Collapse in Fairfax County, Virginia,* Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 94, 91 pages (Feb. 1977) SD Catalog No. C13.29/2:94, $1.55.

Computer Science and Technology

Leong-Honk, B., and Marron, B., *Computer Science and Technology: Technical Profile of Seven Data Element Dictionary/Directory Systems, Nat. Bur. Stand.* (U.S.), Spec. Publ. 500-3, 45 pages (Feb. 1977) SD Catalog No. C13.10:500-3, $1.05.

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NEWS BRIEFS

PURCHASE BY PERFORMANCE. The Department of Commerce has begun an experimental voluntary consumer-product labeling program to aid people in their purchase decisions. Objective data on labels will help consumers by providing product performance characteristics at the point of sale. A distinctive Department of Commerce mark will identify the labels. NBS will provide technical assistance to the program through the Center for Consumer Product Technology.

MEASURING MOISTURE IN GRAIN. NBS and the Department of Agriculture's Federal Grain Inspection Service have agreed to cooperate in developing and maintaining moisture-measuring devices for grain, rice, and pulses (certain leguminous plants and their seeds). NBS research in this area involves studying the accuracy of existing and proposed electronic moisture meters, which measure the dielectric constant of grain, and comparing these meters with the official standard--an oven-drying process. NBS will also try to determine how grain moisture might be measured on a continuous on-line basis.

ASBESTOS MEETING AT NBS. Leading scientific, medical, and government authorities from the United States and abroad will meet at NBS in Gaithersburg, Md., July 18-20 to discuss current problems with defining and measuring asbestos, a common industrial material that may cause cancer and other diseases in workers who are exposed to it. Workshop on Asbestos: Definitions and Measurement Methods is cosponsored by NBS and the Occupational Safety and Health Administration. Experts will discuss mineralogical nomenclature, the relationship between the chemical and physical properties of fibers and health effects, regulatory aspects, and analytical techniques. For further information contact: Ron Johnson, B346 Materials Building, NBS, 301/921-2835.

COMING SOON: QUIET LAWNMOWERS. NBS' Experimental Technology Incentives Program and GSA's Federal Supply Service have announced the award of a $1 million contract for 10,000 power mowers that will reduce the noise levels by as much as 10 decibels. The award went to AMF Lawn and Garden Division, Des Moines, Iowa, and represents a technological improvement through the use of government procurement incentives. AMF expects to add the quieter lawnmower to its line of mowers for sale to the general public.

AGRICULTURE WANTS METRIC SUGGESTIONS. Consumers are encouraged to submit suggestions on metric labels for meat and poultry to the Department of Agriculture. Currently DOA requires the use of customary units, but the agency is looking for non-confusing ways to support metric conversion. Write: Hearing Clerk, DOA, Washington, D.C. 20250.

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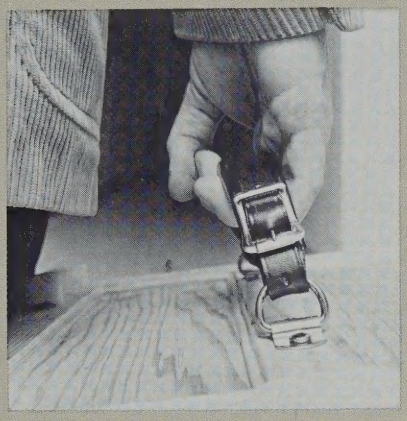
DIMENSIONS/NBS



If your television is labeled "portable" and it develops a problem while under warranty, you have to take it to the repair shop as part of the bargain. The Federal Trade Commission has decided that guidelines are needed to protect the consumer by defining what is portable. Find out how portable is portable in the July issue of DIMENSIONS/NBS.

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